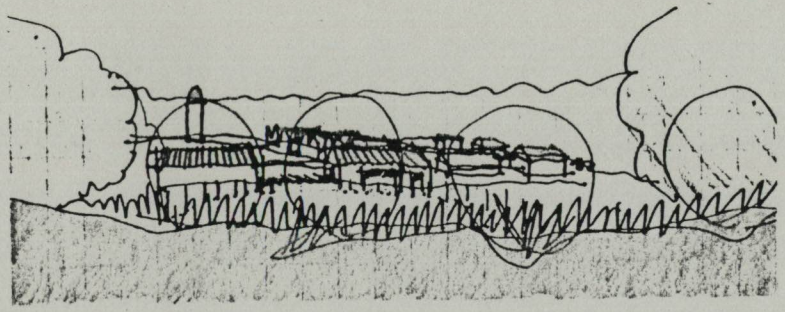
5-1984

Research and Education Center - Edisto Experiment Station

Clark Templeton
Clemson University



Research and Education Center

Edisto Experiment Station

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Spring 1984

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A terminal project submitted to the faculty of the College of Architecture, Clemson University, in partial fulfillment of the requirements for the degree of Master of Architecture.

Spring, 1984

by Clark Templeton

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Harlan E. McClure, Dean, College of Architecture

acknowledges

Acknowledging people's help is important to me because I truly consider this a group project where each person's input was vital to its success.

College of Architecture

I would like to thank the faculty of the College for their encouragement to me the past six years with special thanks to:

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whose dedication to excellence has inspired me.

John D. Jacques, Committee Member
whose concern for people in design and friendships has guided me.

S. C. Agricultural Experiment Station

The staff were always cheerful and ready to help, special thanks to:

Dr. W. C. Godley, Director

Dr. A. W. Snell, Assistant Director.

Edisto Experiment Station

I would like to thank the Edisto Station staff for cheerfully allowing me to question and explore their work environment. My deepest appreciation to:

Dr. J. R. Hill, Jr., Director (and family)
who loved, fed, and took care
of me on all my visits.

Friends

These are all my friends who have a part of themselves in this effort.

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who has shown me what true commitment means.

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Lamar H. Brown, Professor, Mechanical/ Structural Consultant

Martin A. Davis, Associate Professor, Energy/Thermal Comfort Consultant

dedication

I dedicate this project to the three most important persons in my life.

My father and mother, who have sacrificed, loved, and supported me always.

Jesus Christ, who has given me the strength, courage, and joy from within to work excellently.

"Trust in the Lord with all your heart,

And do not lean on your own understanding.

In all your ways acknowledge Him,

And He will make your paths straight"!

Proverbs 3:5,6

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Project Statement

Agriculture is the "...science, art, and business of cultivating the soil, producing crops, and raising livestock useful to man."[1]

In a constantly changing world where the population is increasing, while available farmland and farms are decreasing, the challenge to the agriculture system is to continue to meet man's food needs. One method to meet this challenge is through research to improve crop and livestock quality and production, and land management. Today, the U.S. system of Agricultural Experiment Stations is improving agriculture through research in every state. Scientists combine scientific investigation with practical experimentation to improve agriculture for agriculture businessmen and consumers.

The South Carolina System of Agricultural Experiment Stations is the research branch of the College of Agricultural Sciences of Clemson University and is an important factor in improving

agriculture for the state. As an integral part of the College's teaching and public services program, the five State Agricultural Experiment Stations meet the needs of the farmers and general public of their particular region.

The Edisto Experiment Station, located in Barnwell County, serves the Coastal Plains region of South Carolina. Its goal is to solve agricultural problems of the region's farmers through improved research and extension service. Currently the research facilities at the Edisto Station are inadequate in size, function, and quality. To improve its present and future research programs, a comprehensive station plan is needed with a new Research and Education Center as its focus. The plan would include a system of field layouts, circulation, and storage sub-centers integrated with the Research and Education Center. A more efficient station plan and research environment

will permit the Edisto Station to continue to effectively fulfill its research and extension mission.

Project Objectives

The primary objective of this project is to establish a framework for the Edisto Experiment Station in which the different activities can work together in a mutually reinforcing and beneficial manner. The following goals are elements of this framework.

station plan

A comprehensive plan of the station is needed to define various land areas by use (crops or cattle) or by natural factors (trees, terrain, etc.). The land areas are smaller groupings of station activities with focal points as visual orientation markers.

movement system

The circulation system should be an efficient network relating the different field areas of the station plan. Specifically, it should coordinate the public and private movement on the station. The public should become more aware of the station's research fields and natural features as well as have good access to the Research and Education Center. The private users (station employees) should have uninterrupted and close access from their interior work spaces to the fields.

buildings

The buildings of the station should reinforce and accentuate the circulation paths, relate to the field areas, and capitalize on attractive views. The Research and Education Center should be the focal point of the public circulation as well as the primary center for field access. The storage and equipment buildings should be located at sub-centers to serve the different field areas with a strong link to the Research and Education Center.

Introduction

Agricultural Business or Agribusiness is perhaps the most important industry in the United States. Consider these facts:

The U.S. is the largest farm products exporter in the world with a 10.5 billion dollar net gain compared to a 40.2 billion dollar net deficit in total non-agricultural trade.

Agriculture is the largest industry in the U.S. with 3/5 the capital assets of all manufacturing businesses.

Agriculture is the largest employer with 14 - 17 million people in jobs from the fields to the marketplace.

In 1077, 300 million acres were farmed in the U.S. of which 198 million were prime cropland. However, each year the U.S. loses 3 million acres of farmland.

One farmer produces food and fiber for 56 people.[2]

Agriculture is extremely important to this nation and the world, but to continue to meet the increasing demands of this nature, agriculture products and methods need to improve. This is the goal of the U.S. system of Agricultural Experiment Stations.

In South Carolina, agribusiness is one of the top industries with cash receipts now near the 5 billion dollar mark. But as agribusiness increases monetarily, the natural resources and manpower involved are decreasing. In South Carolina in 1960 there were 86,000 farms, utilizing 10,000,000 acres, whereas in 1980 those figures dwindled to 33,000 farms using 6,100,000 acres. At the same time, South Carolina's population rose from approximately 2 million people in 1960 to 3.1 million in 1980 and is expected to grow to 3.8 million by 1990.[3]

As the number of farmers and amount of available farmland decreases, while the population increases, South Carolina farmers are having to increase their production through more capital, science and technology, managerial expertise, and research. Research at the state's Agricultural Experiment Stations is essential to improving agribusiness in South Carolina.

Agricultural Experiment Stations

their origins

The U.S. system of Agricultural Experiment Stations has been advancing agriculture through research since 1875. The first official experiment station with government support was begun in Germany in 1852 and by 1855, Samuel Johnson, then a Yale College student, brought these ideas to the U.S. The first U.S. station was established in Connecticut by Johnson in 1875 to be "...devoted to the advancement of agriculture by means of scientific investigation carried on in close connection with practical experiment...."[4] These goals were widely accepted and by 1885 thirteen more states had experiment stations.

Johnson had two alternatives as how to operate the stations. They should either be controlled by the state government or by colleges. He felt that state control was best because it would provide a constant financial base and ensure service to the farmers and general public as its primary purpose. Allowing colleges to

control the stations, Johnson thought would be a conflict between the teaching commission of a college and the public service emphasis of the stations. Today, however, most of the state experiment station systems are part of a college system, with emphasis on public distribution of research conclusions. Periodical reviews insure a balance between research and public interaction.[5]

The agricultural experiment station today continues to help meet the food needs of the U.S. and world through research and information distribution. Samuel Johnson's initial ideas of improved research through a union of theory and practice continue to be the foundation of the experiment stations.

development in S.C.

Agricultural research in South Carolina began in 1669 when the Lord's Proprietors of the new settlement began a test garden of ten acres on the Ashley River to determine crops that would grow well in the new environment. The need for improving crops continued and by the middle of the 1800's three important events occurred that led to the S. C. Experiment Station System of today. In 1886 the S.C. General Assembly passed a bill establishing a state system of experimental farms, with the first one near Spartanburg. Secondly, in 1887, the U.S. Congress passed the Hatch Act that gave federal financial support for state agricultural experiment stations. Finally, in 1889, the S.C. General Assembly accepted land willed by Thomas G. Clemson for the establishment of an agricultural experiment station with the right to use federal and state funds for research on agricultural problems. Since then

the S.C. Experiment Station system has been based at Clemson University and is the research and public services branch of the College of Agricultural Sciences.[6]

current status

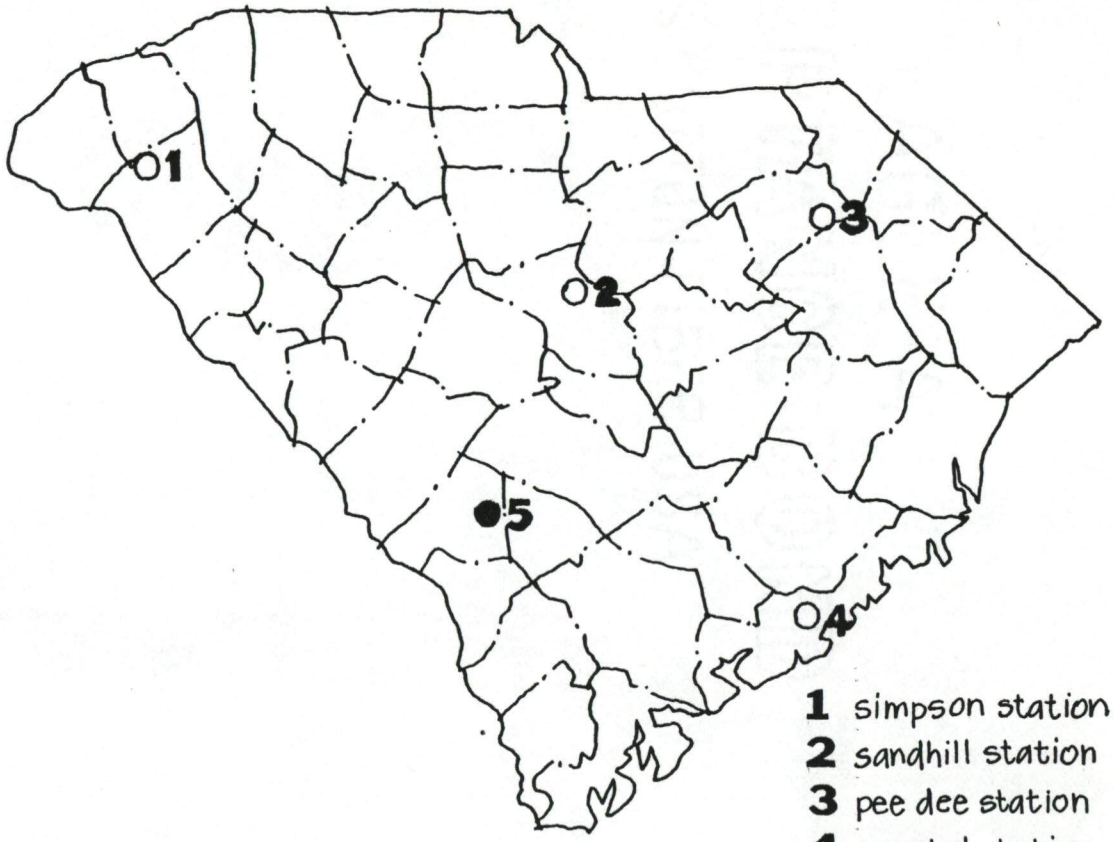
The headquarters of the S.C. Agricultural Experiment Station is at Clemson University, Clemson, S.C., where they coordinate the five branch stations in the state. The stations are the Simpson Station, at Clemson University, the Sandhill Station, near Columbia, the Pee Dee Station, near Florence, the Coastal Station, near Charleston, and the Edisto Station, near Blackville.

The goal of the South Carolina Agricultural Experiment Station is to conduct research in agriculture and to provide their knowledge to all aspects of society.

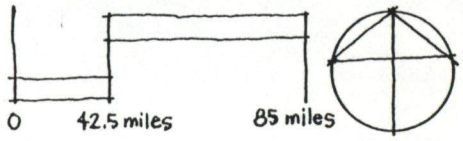
> Besides serving farmers and homemakers, the station conducts a sizeable portion of research needed by agribusinesses which supply the inputs for agricultural production, such as farm chemicals and fertilizers, farm machinery, fuel, feed, seed, and building materials, and by those which market, process, and distribute food and other farm products.[7]

The research done at each station benefits farmers and each person in South Carolina as well.

state plan



1 simpson station
2 sandhill station
3 pee dee station
4 coastal station
5 edisto station



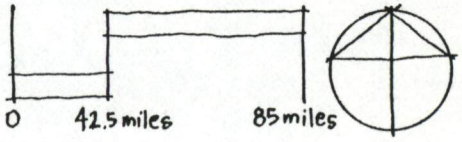
The Edisto Station

the setting

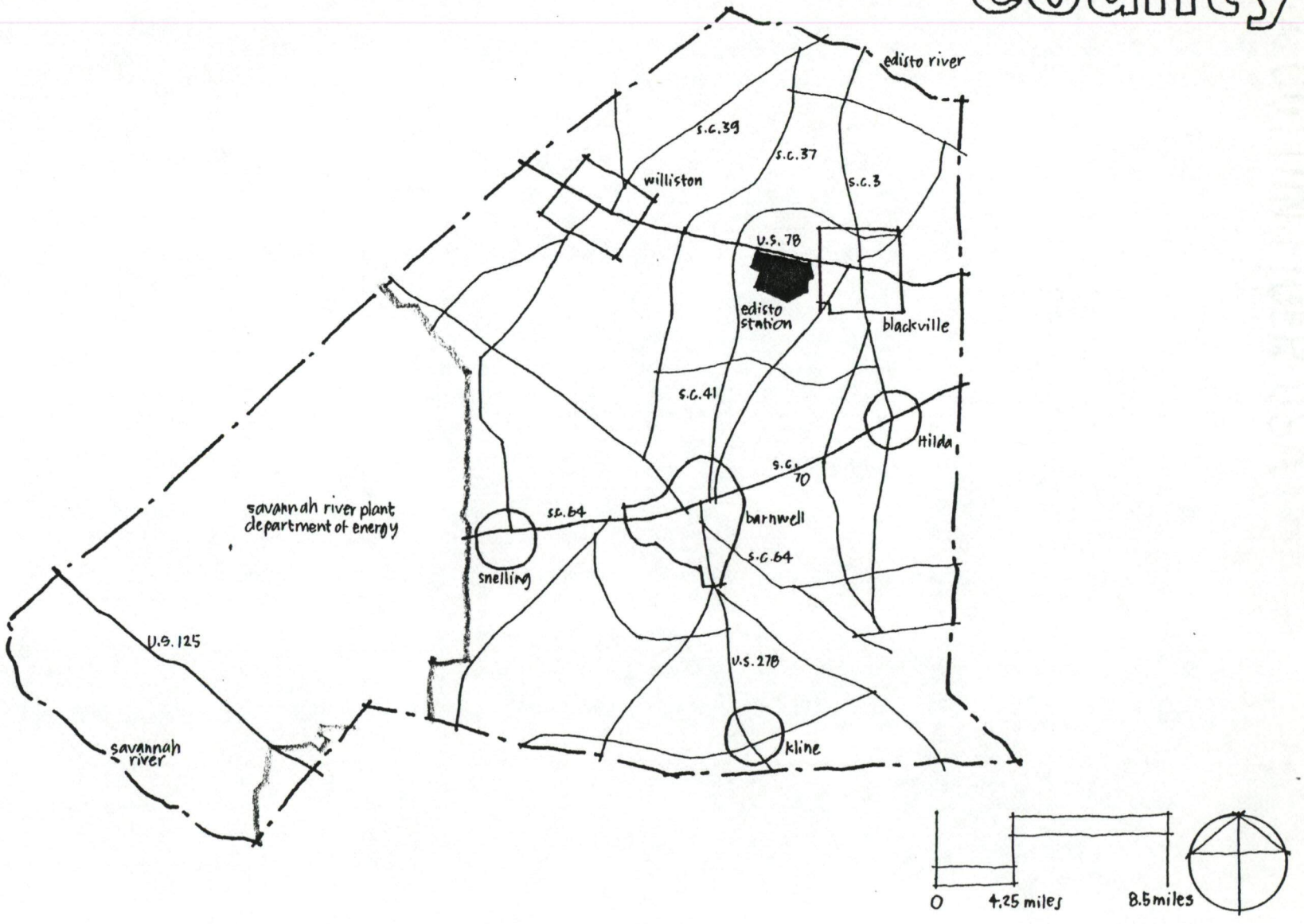
The Edisto Experiment Station is in the south-central part of South Carolina, serving the fifteen counties of the Coastal Plains region. It is located in Barnwell County, on S.C. Highway 78 between Williston and Blackville, and north of Barnwell. There are 19,077 residents of Barnwell County with land totalling 354,000 acres, of which 132,000 acres belong to the Savannah River Plant of the Atomic Energy Commission. The primary industry in Barnwell County and the Coastal Plains region is farming and as such, research at the Edisto Experiment Station is vital to its economic growth.[8]

region

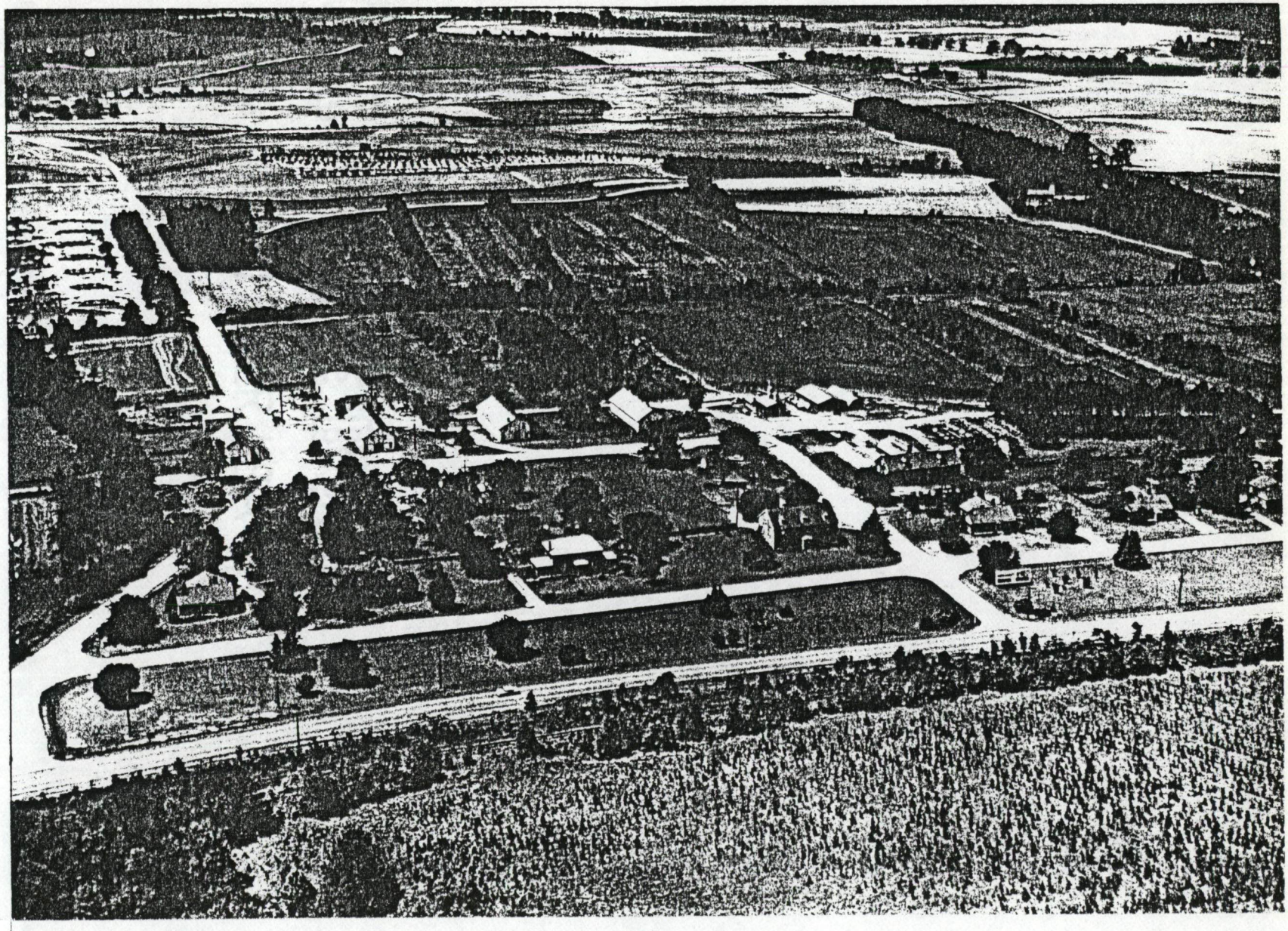

edgefield
aiken
calhoun
clarendon
orangeburg
edisto
barnwell
bamberg
dorchester
berkeley
allendale
colleton
hampton
charleston
jasper
beaufort


0
42.5 miles
85 miles

barnwell county



station entry aerial



station genesis

The Edisto Experiment Station was initiated on February 11, 1936 by three scientists on 200 acres of land. The station has subsequently grown tenfold through land purchases, personnel additions, crop/livestock expansion, and building growth. Currently the station has an abundance of land, but as research increases with a new and expanded research center, the station will continue to expand its land holdings. The following dates mark the key growth periods and are selected primarily according to major land acquisitions during the time period:

1936

1939

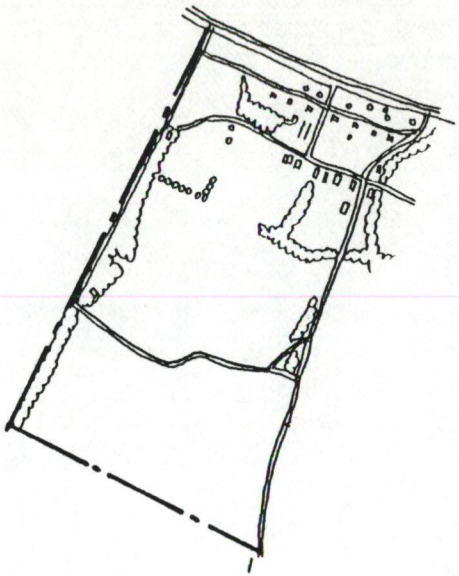
1946

1955

1984

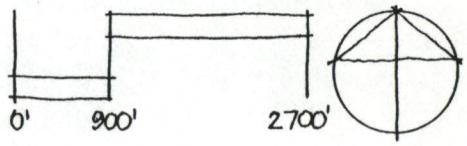
2000

1936

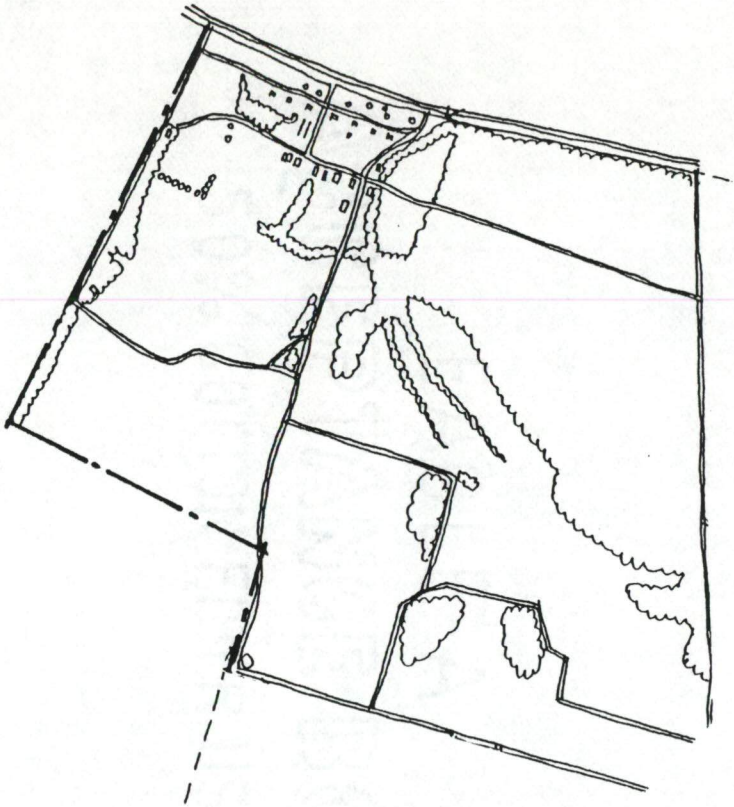


Land : 200 acres
People : 3 scientists
Crops/Livestock : cantaloupes, watermelons

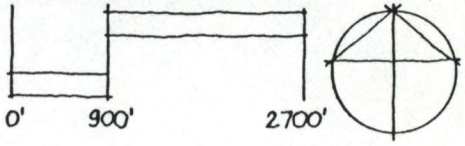
Buildings : offices, barns, residences

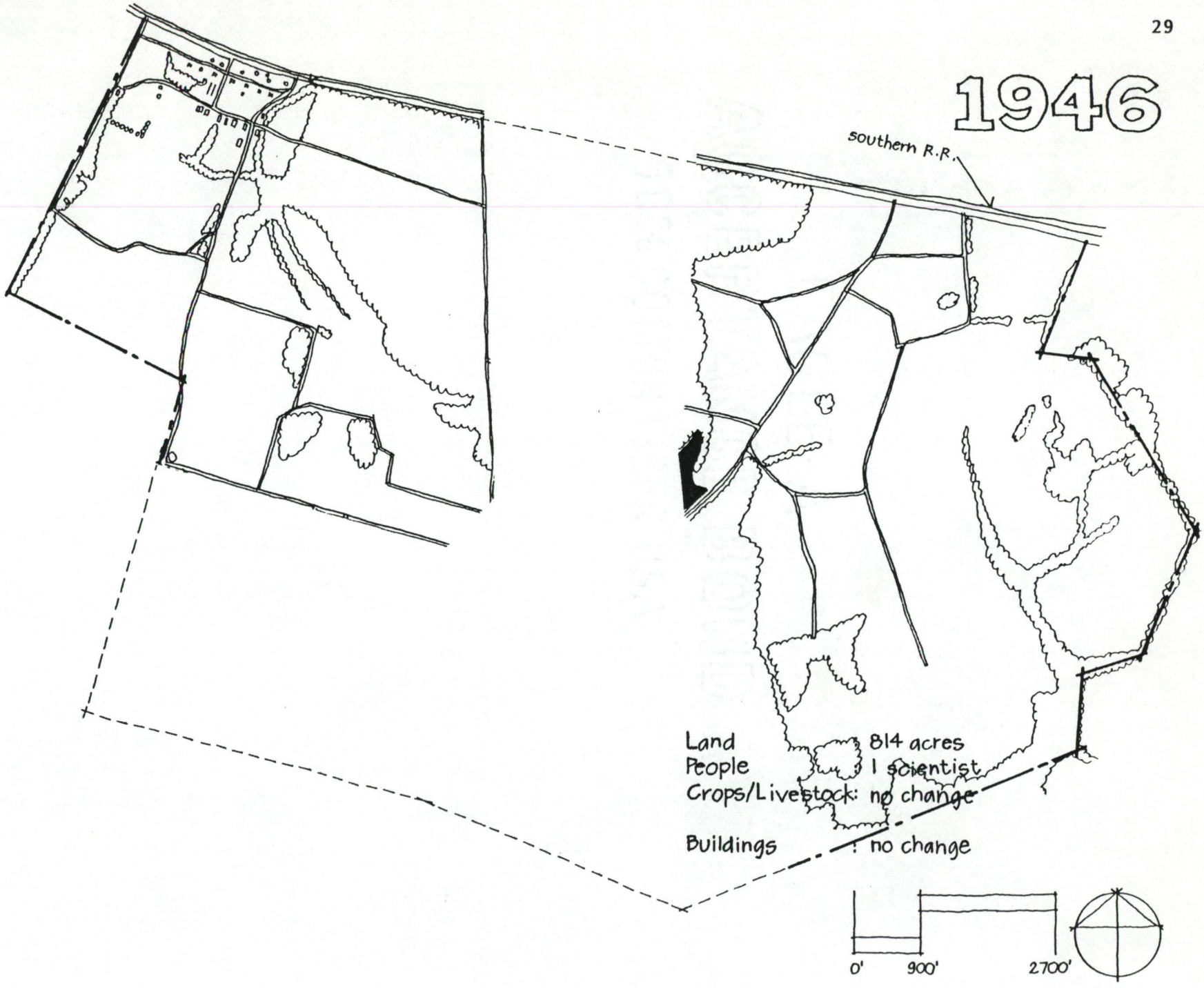


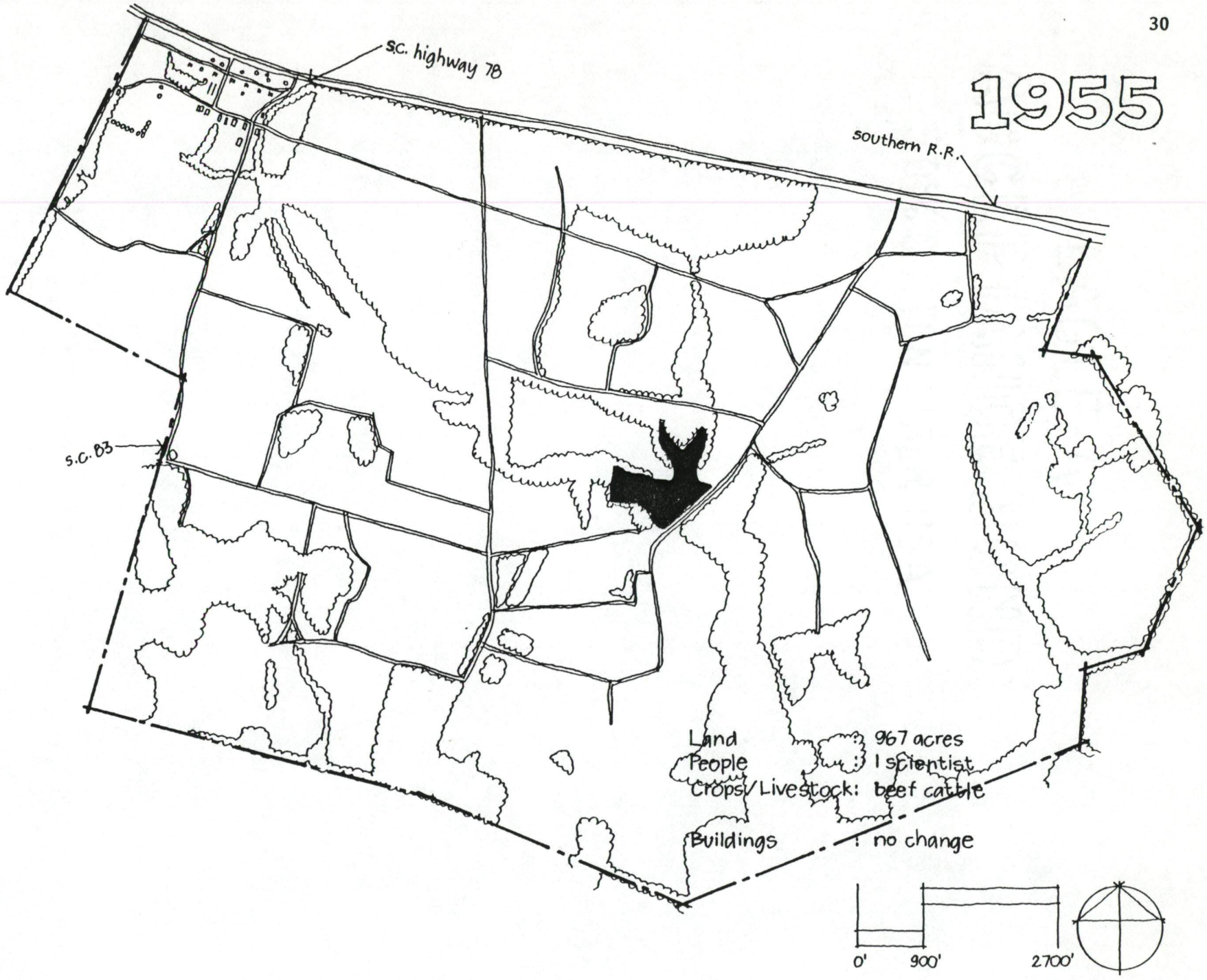
1939

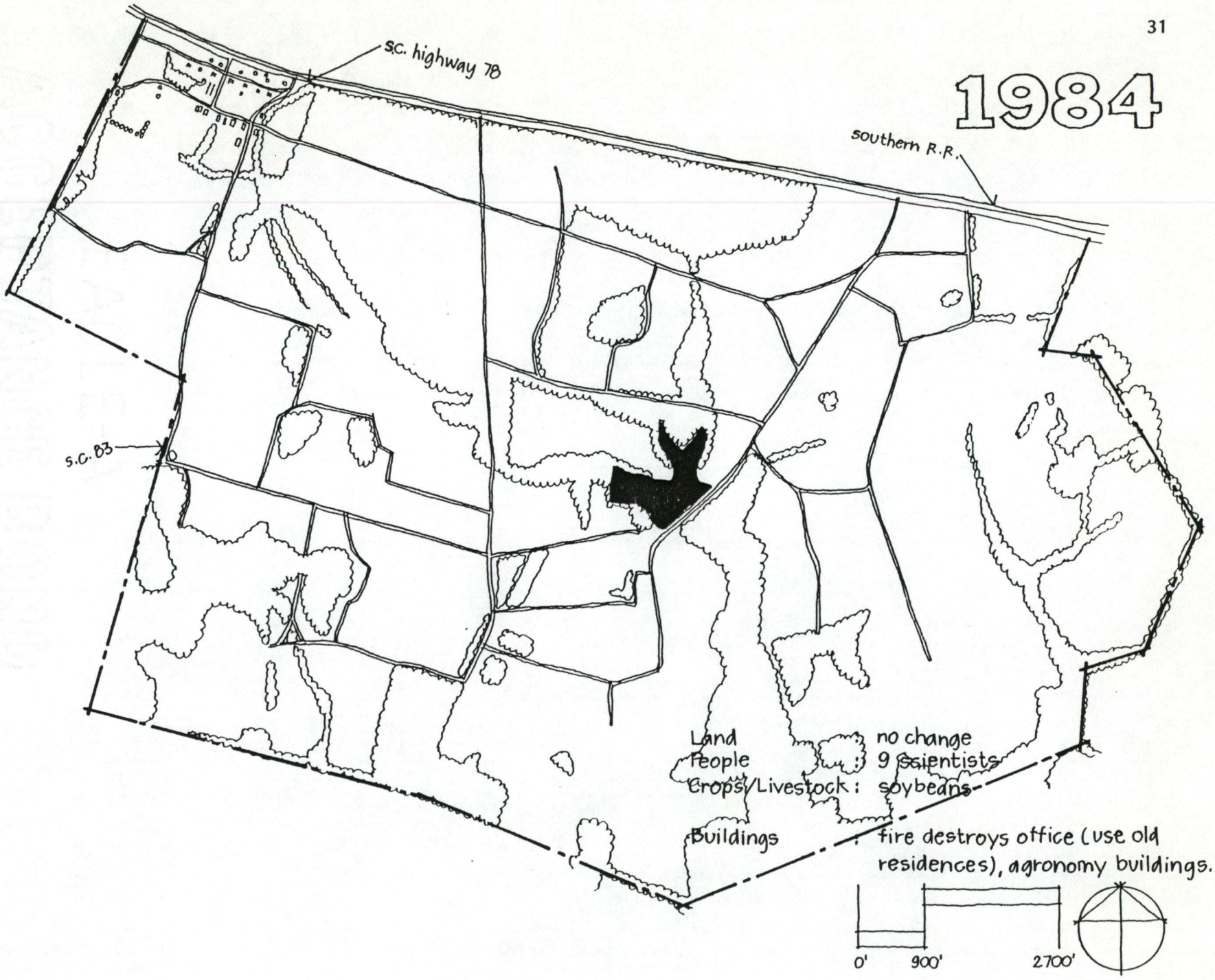


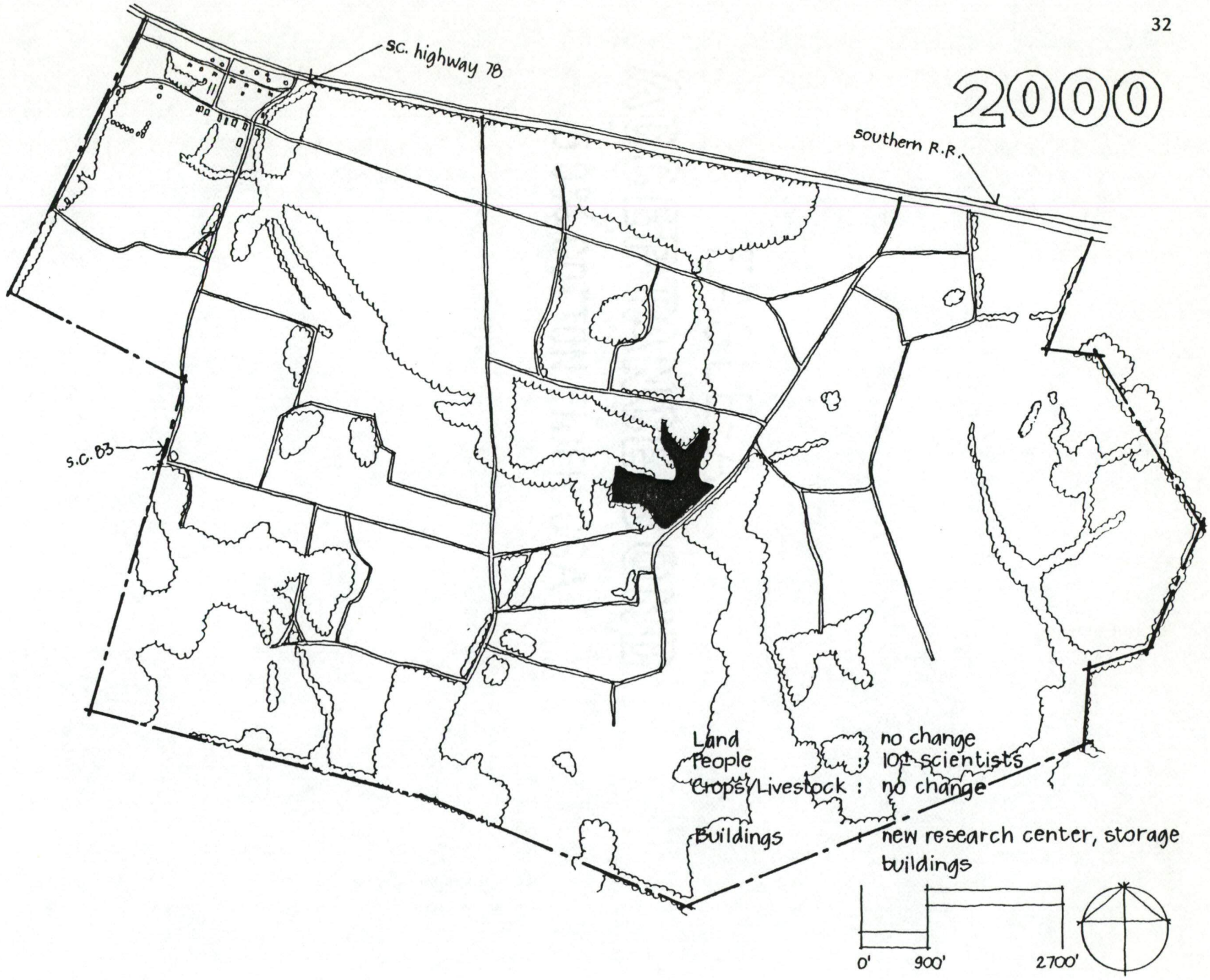
Land : 373 acres
People : 1 scientist
Crops/Livestock: sweet potatoes, cotton
Buildings : crop/machinary storage, laborer houses




1946
southern R.R.
Land : 814 acres
People : 1 scientist
Crops/Livestock: no change
Buildings : no change
0'
900'
2700'


1955
S.C. highway 78
Southern R.R.
S.C. 83
Land : 967 acres
People : 1 scientist
Crops/Livestock: beef cattle
Buildings : no change
0'
900'
2700'


1984
S.C. highway 78
southern R.R.
S.C. 83
Land : no change
People : 9 scientists
Crops/Livestock : soybeans
Buildings : fire destroys office (use old residences), agronomy buildings.
0'
900'
2700'


2000
S.C. highway 78
southern R.R.
S.C. 83
Land : no change
People : 10± scientists
Crops/Livestock : no change
Buildings : new research center, storage buildings
0'
900'
2700'

purpose and organization

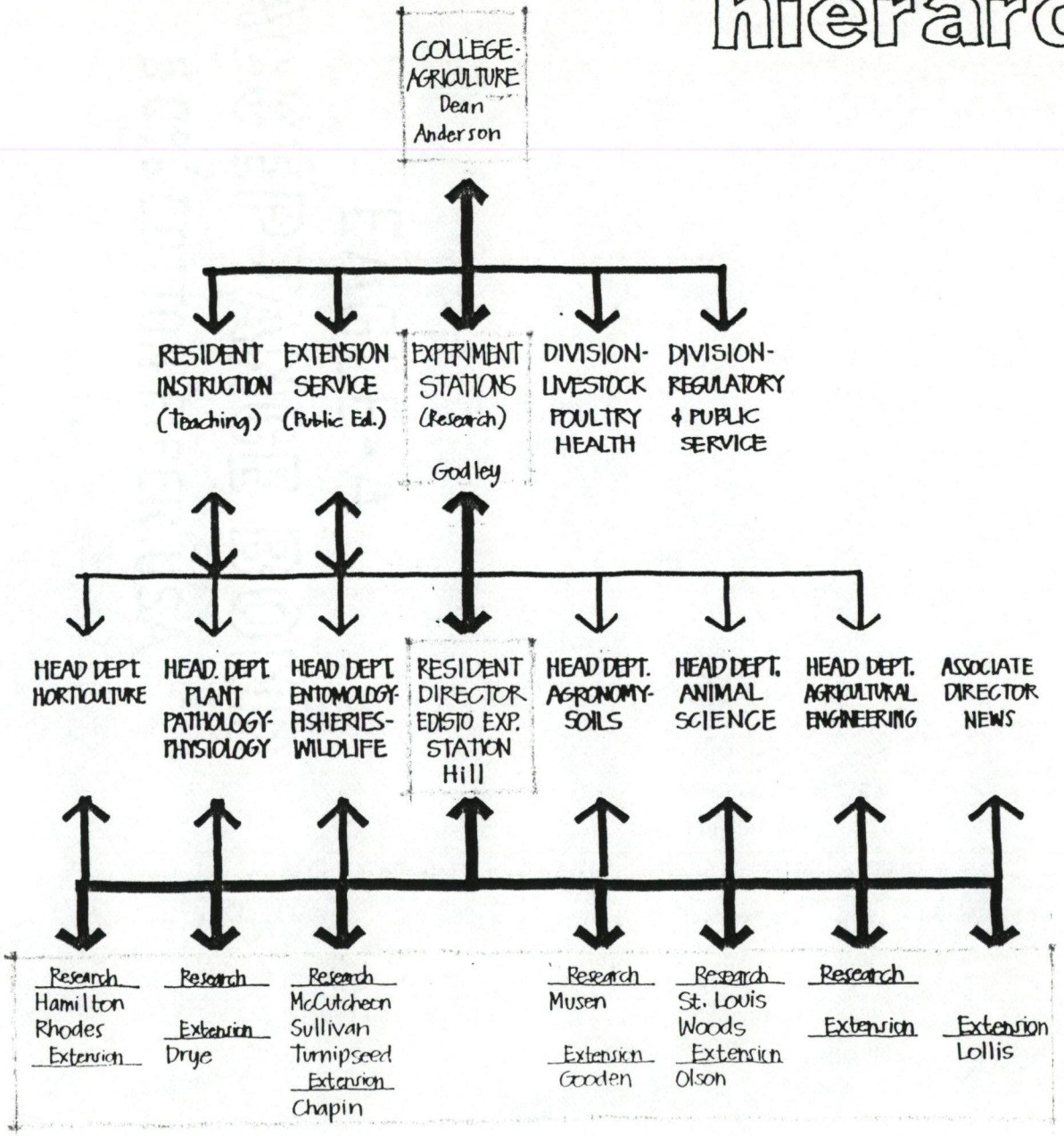
The Edisto Experiment Station has two principal purposes. The first is to respond to agricultural problems in the Coastal Plains region through extension studies and applied research. The second purpose of the station is to further its research program through an interdisciplinary approach.[9] For example, researchers in plant pathology, entomology, and agronomy are currently working together to improve soybean production and quality.

The organizational structure of the Edisto Station is based on two important relationships; one within the College and the other within the station itself. Combined they insure a close interrelationship between the College and the Agricultural Experiment Stations.

The Dean of the College of Agricultural Sciences at Clemson University, Dean L. P. Anderson, is in charge of each branch of the College. The research branch, the S.C.

Agricultural Experiment Station, is headquartered at Clemson University and directed by Dr. W. C. Godley and his associate, Dr. A. W. Snell. Dr. Godley is in charge of each experiment station and their directors, each of whom are equal in position to a department head at the College. The director of the Edisto Experiment Station, Dr. J. R. Hill, Jr., reports to Dr. Godley and coordinates all work at the Edisto Station. Scientists within each department at the Edisto Station coordinate their work with the station director, as well as the College department heads.[10] A well working relationship between the scientists, the region's farmers, other station departments, and their College department heads, is necessary to insure that the purposes of the Edisto Station are being met.

hierarchy



The Components

There are four components or work divisions within the Edisto Experiment Station. They are administration, extension, research, and field. Each component working together is vital to the overall success of the station.

administration

The Station administration coordinates all station activities and is the primary link to Clemson University. The resident director, Dr. J. R. Hill, Jr., supervises the extension, research, and field work, and reports to the Agricultural Experiment Station Director, Dr. W. C. Godley, at Clemson University. The other members of the administrative department are a bookkeeper and three secretaries. The bookkeeper, Mrs. Bates, works closely with the director on financial aspects and employment factors. She also supervises the secretaries consisting of the general secretary, the extension secretary, Mrs. Copes; and the research secretary, Mrs. Fickling.[11]

Currently, the primary problem of the administrative department is lack of personnel. Specifically, there is a need for an assistant to the bookkeeper as well as three additional secretaries.[12] Increased personnel would aid

the administrative staff to better accomplish their specific tasks and effect a more efficient administrative department.

extension

The Extension component at the Edisto Experiment Station has two major purposes. One is to work closely with research personnel to develop solutions to different crop problems. The second purpose, and perhaps the most important, is to provide this research information to the public. Extension scientists work directly with farmers, county agents, and frequently set up field demonstrations. For large groups they also provide information through the media to the general public. Public contact is extremely important for extension scientists not only to distribute information but also to identify new problems.

Extension scientists have been based at the station since 1978, and currently there are five full time Extension Specialists in the field of Agronomy, Animal Sciences, Entomology, Plant Pathology, and Public Relations. In the future more specialists will be added in Animal Science and Agricultural Engineering Departments.

The Extension Specialist of the Agronomy Department is Dr. Dewitt T. Gooden, who works primarily with soybeans, peanut education programs, sunflowers, corn, grain, sorghum, forages, and cotton. The objectives of the Agronomy extension work are as follows:

1. Improve technical equipment for demonstrations.
2. Update agents and farmers of new cultural and production practices.
3. Keep abreast of latest findings through meetings, workshops, etc.
4. Improve working relationship with business and support groups.
5. Become more aware of production, economic, and social problems.
6. Increase peanut yields to equal neighboring states.
7. Develop integrated pest management programs (I.P.M.) for peanuts and soybeans.[13]

Dr. Larry W. Olson is the Extension Specialist in the Animal Science Department. He works as the swine extension specialist for the state and his major emphasis is improving the breeding, feeding, and management of beef cattle. The following are objectives of the Animal Science Extension Program:

1. Conduct and improve State Beef Cattle Days, State Swine Days, Bull Test Station Sale Day.
2. Attend meetings to keep abreast of current information.
3. Explore beef cattle improvement program.[14]

Extension work in the Entomology Department is directed by Dr. Jay W. Chapin, who coordinates integrated pest management (I.P.M.) programs for soybeans, peanuts, and other field crops. The components of the I.P.M. program are to provide grower education through meetings and demonstrations, monitor insects, deliver public information weekly, and conduct scout training programs. The objectives of the department as described by Dr. Chapin are to:

1. Expand soybean and peanut acreage under management.
2. Concentrate demonstration efforts on pest resurgence.
3. Identify aids for soybean and peanut pest insects.
4. Develop population models for soybean pests.[15]

The Plant Pathology Extension Specialist is Dr. Charles E. Drye who works with soybeans, peanuts, pecans, and commercial vegetables. The objectives of the extension program in Plant Pathology are to:

1. Develop well-controlled and conducted on-station demonstrations.
2. Improve staff support work.
3. Increase theemphasis on educational activities.
4. Develop I.P.M. activities.
5. Improve physical facilities and efficiency of current work.[16]

The Public Relations Director is Mr. Tom Lollis who distributes research information to the public through the news media. He also maintains contact between the station research and extension staff and farmers during field days. The Public Relations Department's objectives are to:

1. Develop a slide presentation for station visitors.
2. Conduct "open house" for students.
3. Develop a "visitor center" display.[17]

Each extension department specialist requires a good working relationship with researchers to be able to convey research information to the public. The extension component is the vital link between research theory and practical application by the public.

research

The research component of the Edisto Experiment Station seeks solutions to agricultural problems of the Coastal Plains region. This is accomplished through a team approach of Edisto Station and University researchers, and extension specialists.[18] Research at the Edisto Station is currently conducted in Agronomy, Animal Science, Entomology, Horticulture and in the future; Agricultural Engineering and Plant Pathology.

The Agronomy Department is led by Dr. Harold L. Musen who works primarily with soybeans, which is South Carolina's leading crop. There have been many contributions from the Agronomy research at the Edisto Station such as:

1. Matching varieties to planting dates.
2. Subsoiling for higher yields.
3. Improving root systems.
4. Developing different soybean varieties.
5. Conducting irrigation studies.
6. Controlling nematodes.

Currently Dr. Musen performs research and variety tests on soybeans, cotton, peanuts, corn, sunflowers, and grains, and studies optimum crop response from irrigation and effective water resource use.[19]

There have been many research advancements with beef cattle in the Animal Science Department led by Dr. D. G. St. Louis and Mr. Sam G. Woods, including:

1. Forage production (non-pasture feeding).
2. Harvesting and storing grains.
3. Finishing cattle on a grain-on-grain system.
4. Freeze branding.
5. Artificial insemination and cross-breeding.

The goals of the Animal Science Research work are to improve beef cattle through feeding studies as well as total management systems.[20]

The research specialists in the Entomology Department are internationally recognized for their excellent work. Dr. G. S. McCutcheon, Dr. Mike J. Sullivan, and Dr. Sam G. Turnipseed have made many contributions such as:

1. Use of economic thresholds to control pests.
2. Insecticides to control soybean pests and to save beneficial pest predators.
3. Savings in insecticide costs.
4. Insect-resistant soybean varieties.

The goals of these scientists are to continue threshold refinement, improve insecticides, develop multiple pest resistant varieties, and improve regulation of pest population through use of natural enemies.[21]

Dr. J. G. Hamilton who researches sweet potatoes and Dr. B. B. Rhodes who studies canaloupes and watermelons, are the Horticulture Research Scientists. Both work closely in storage and processing their crops and have made contributions that include:

1. Varieties of cantaloupe that are disease resistant and higher yielding.
2. The "Wade" plum variety.
3. Subsoiling to gain higher yields.
4. "Resisto" sweet potato variety with a high level of resistance to insects.

Dr. Hamilton's current work is developing crop management practices and varieties of sweet potatoes for both human consumption and as a biomass source for making fuel alcohol. This is a joint project with U.S.D.A. scientists. Dr. Rhodes is researching disease resistance in cantaloupes and watermelons.[22]

The research work at the Edisto Station is vital to the success of South Carolina agriculture. An example of this has been the improvements in South Carolina's soybean crop because of the Edisto team of Agronomists working with soils, Entomologists controlling soybean insect predators, and Plant Pathologists developing better soybean plants. The interdisciplinary approach has proven beneficial in comprehensively solving agricultural problems in the Coastal Plains region.

field

The Field Component's task is to work with the research scientists in producing crops. This involves soil preparation, planting, plant and soil care, harvesting, and maintaining all the equipment. The Farm Manager, Mr. George Wells, reports directly to the Station Director, Dr. Hill, in coordinating all the fields on the station. Mr. Wells is the link between the administration, extension, and research components and the field workers.[23]

The interaction between each component at the Edisto Station is necessary to effectively solve agricultural problems. It is vital that the new Research and Education Center be planned to facilitate teamwork by all of the station components.

The Site

In order to select an appropriate location for the new Research and Education Center, a comprehensive analysis of the entire station must be undertaken. Characteristics which will be examined are as follows:

Climate

Tree Cover

Topography

Watershed

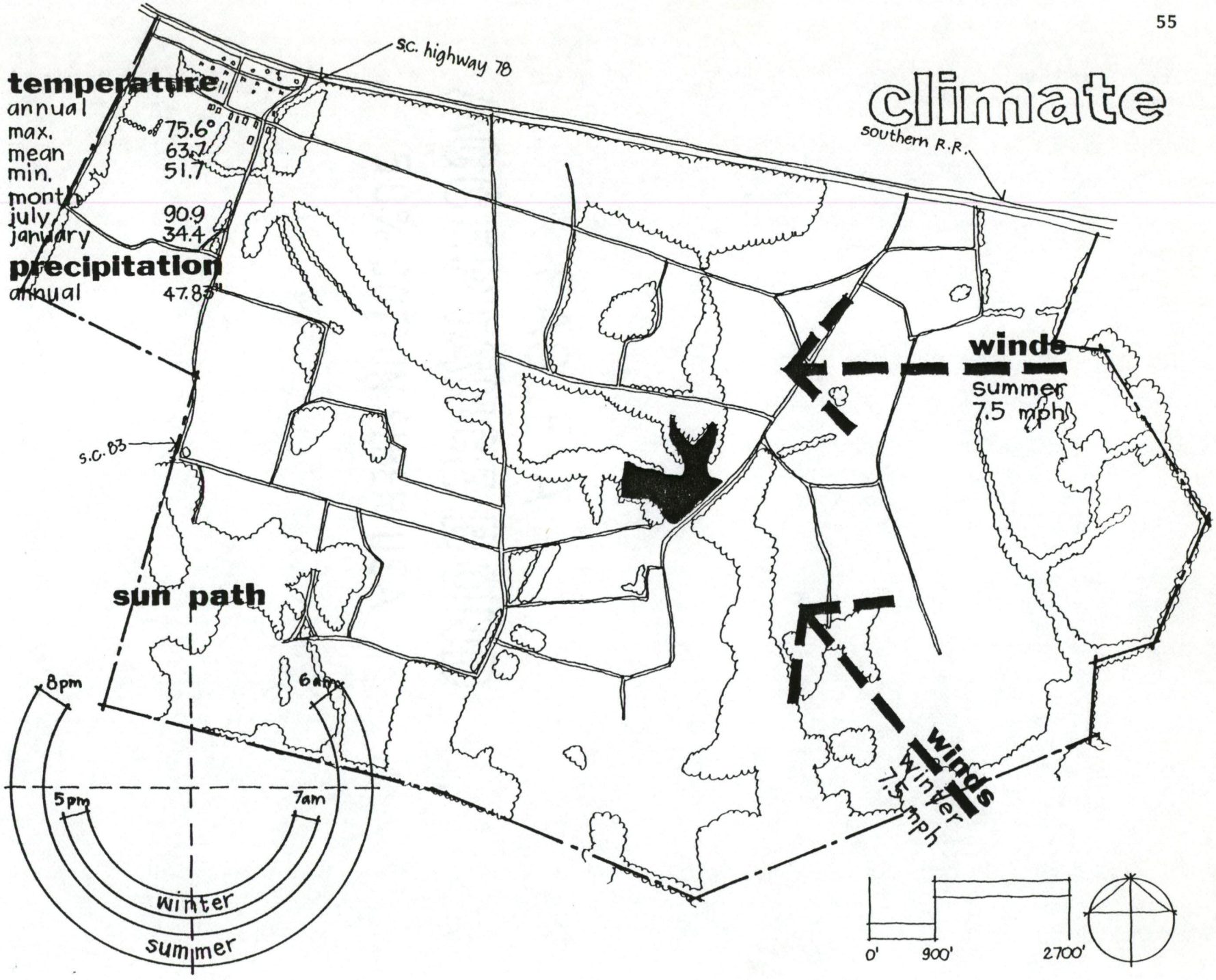
Soils

Perception

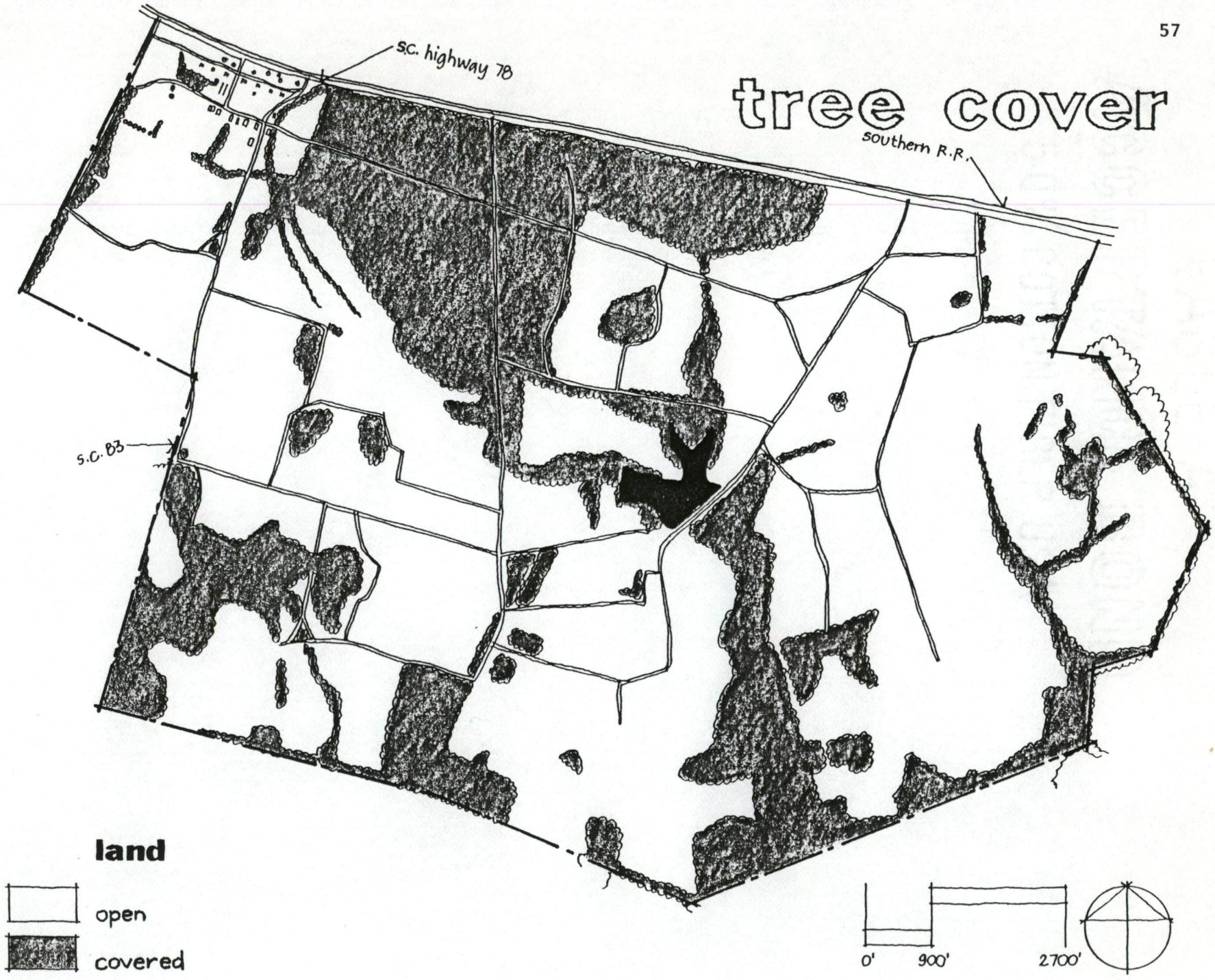
Movement

Land Use

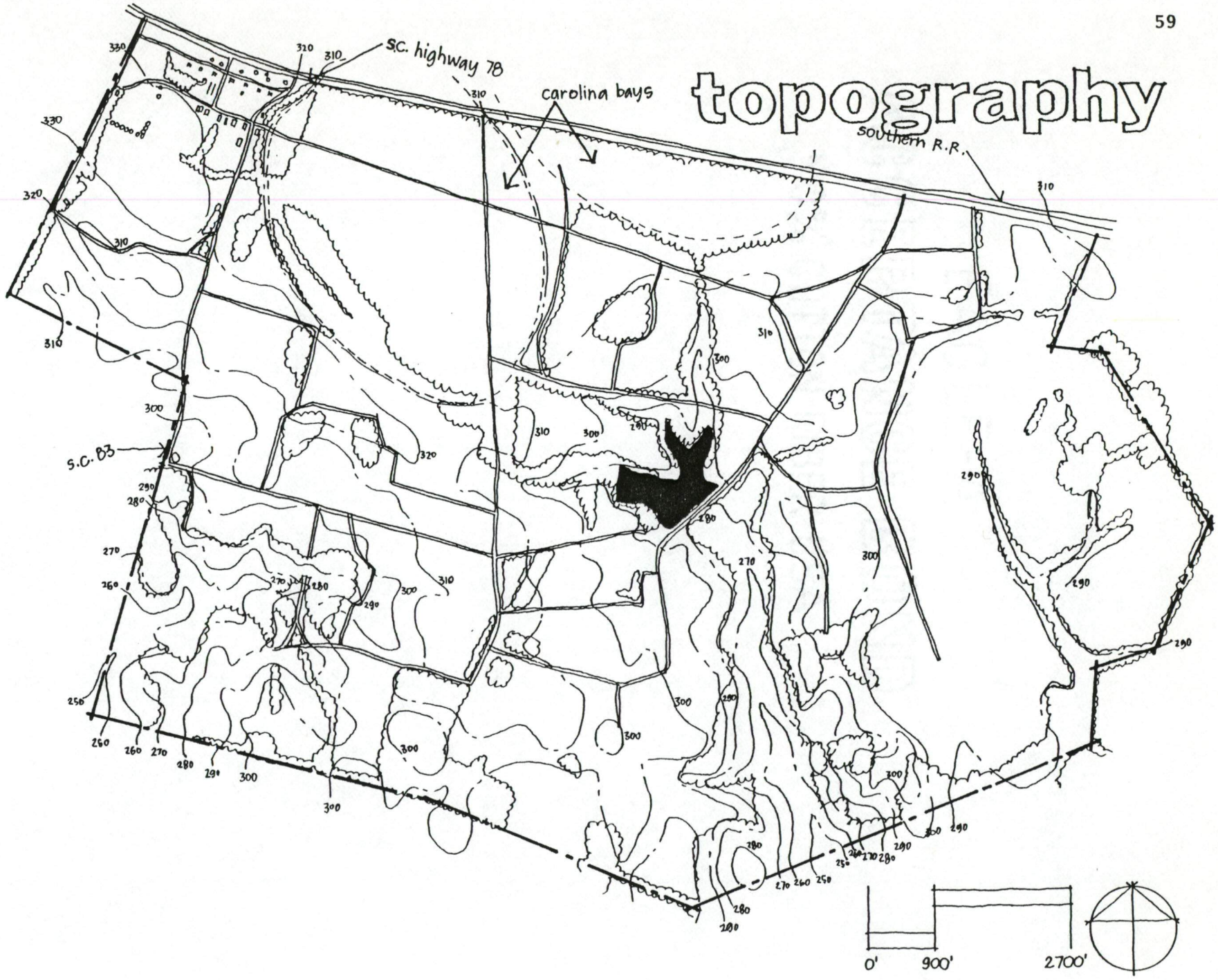
climate


s.c. highway 78
southern R.R.
s.c. 83
temperature
annual
max. 75.6°
mean 63.7
min. 51.7
month
july 90.9
january 34.4
precipitation
annual 47.83"
winds
summer
7.5 mph
winds
winter
7.5 mph
sun path
8pm
6am
5pm
7am
winter
summer
0'
900'
2700'

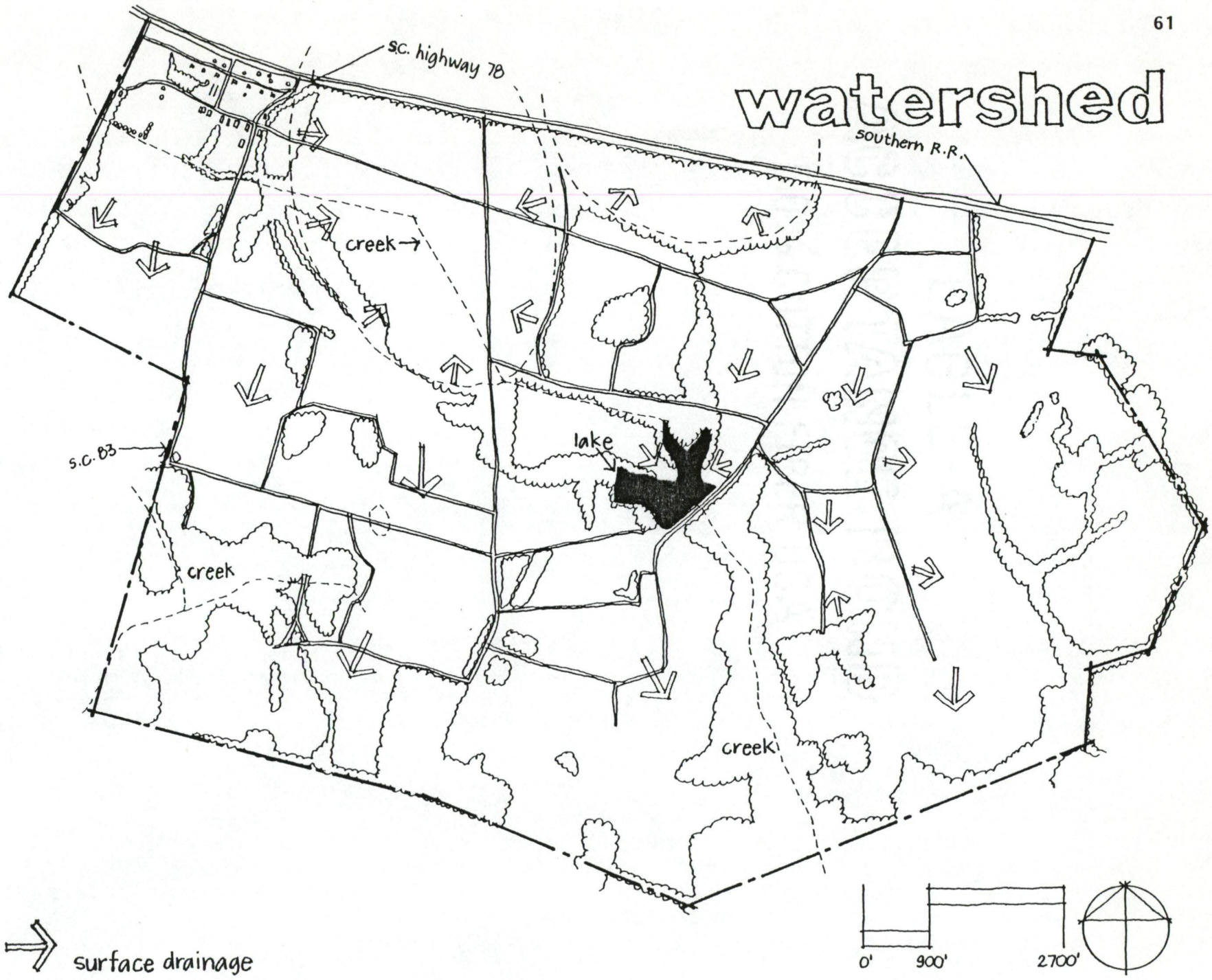
The mild climate and light, variable winds indicates that the station is in a productive farming region and favorable area for buildings to take advantage of sunlight and heat, and natural ventilation for cooling.


tree cover
S.C. highway 78
southern R.R.
S.C. 83
land
open
covered
0'
900'
2700'

The location of tree cover reveals land for future expansion and open areas for fields.

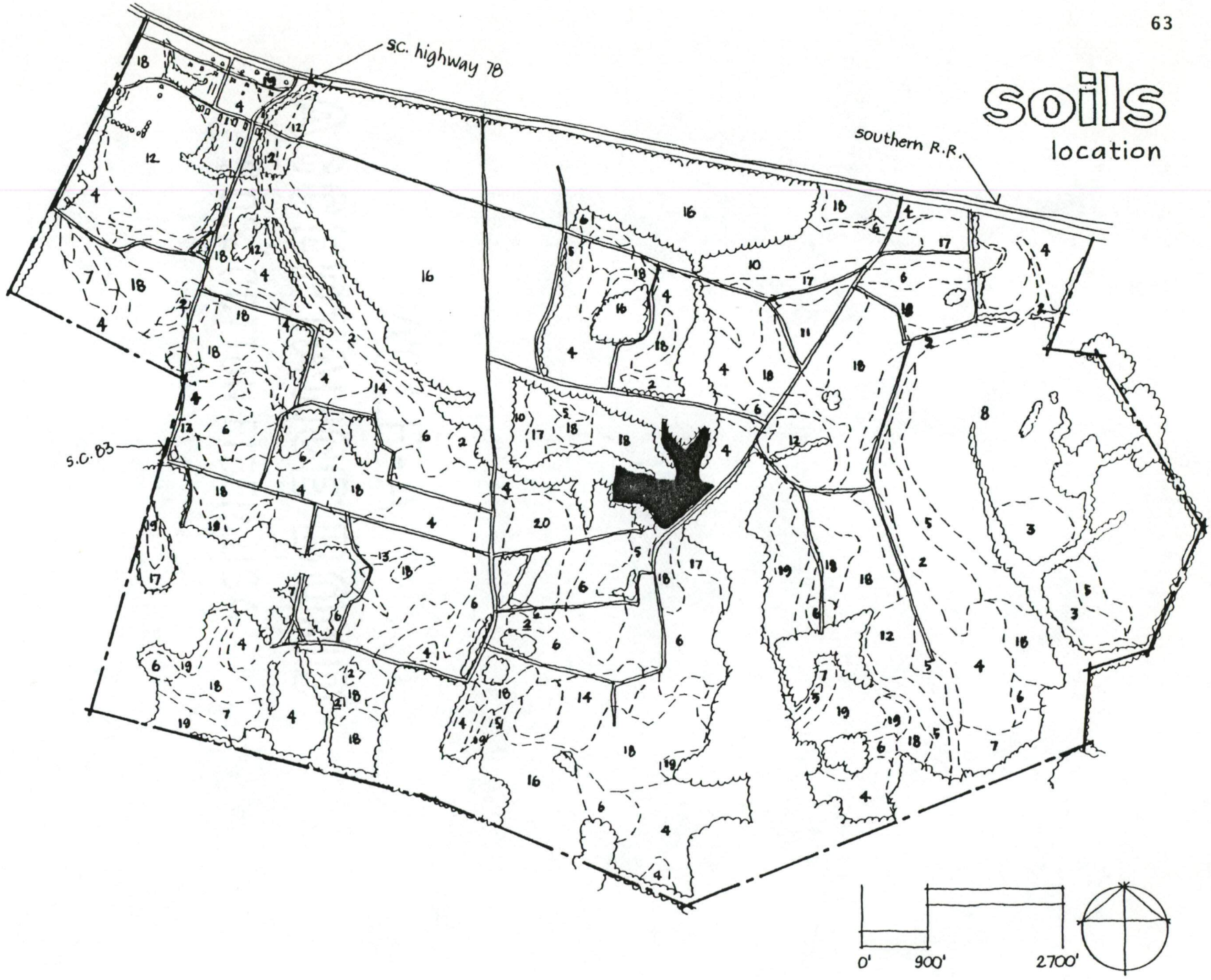

topography
S.C. highway 78
carolina bays
southern R.R.
S.C. 83
0'
900'
2700'

Although the station is generally level with large, flat planting areas, there exists a 60-foot elevation difference across the land. An interesting characteristic of this region are "Carolina bays" which are large oval land areas, formed by the ocean, that are slightly lower and consequently wetter than surrounding land. Two Carolina bays are located on the northern part of the station.

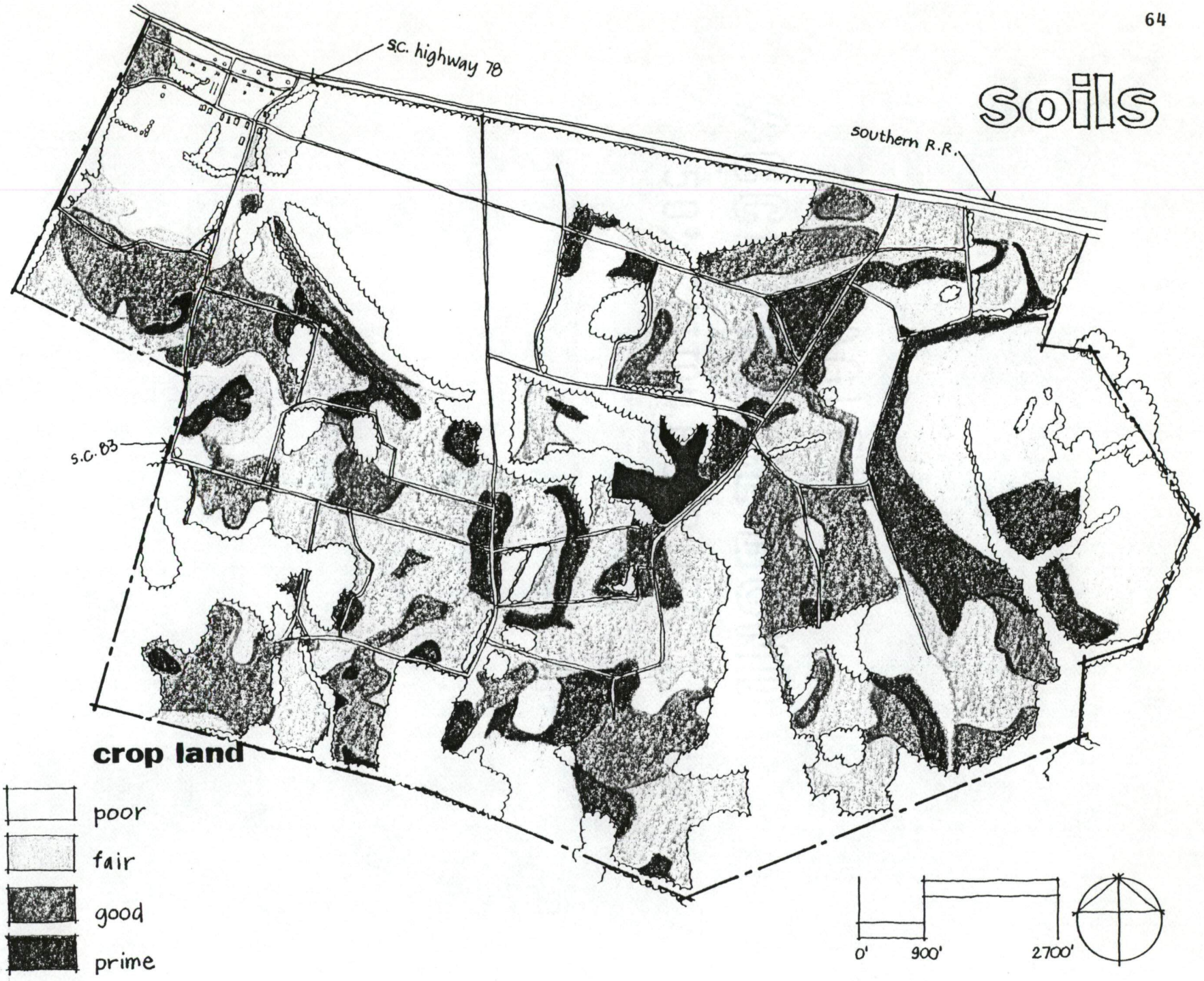

watershed
S.C. highway 78
southern R.R.
creek
lake
S.C. 83
creek
creek
surface drainage
0'
900'
2700'

The location of lakes, ponds, creeks, and drainage patterns identify water supplies and design features that influence crops and buildings.

soils
location



soils

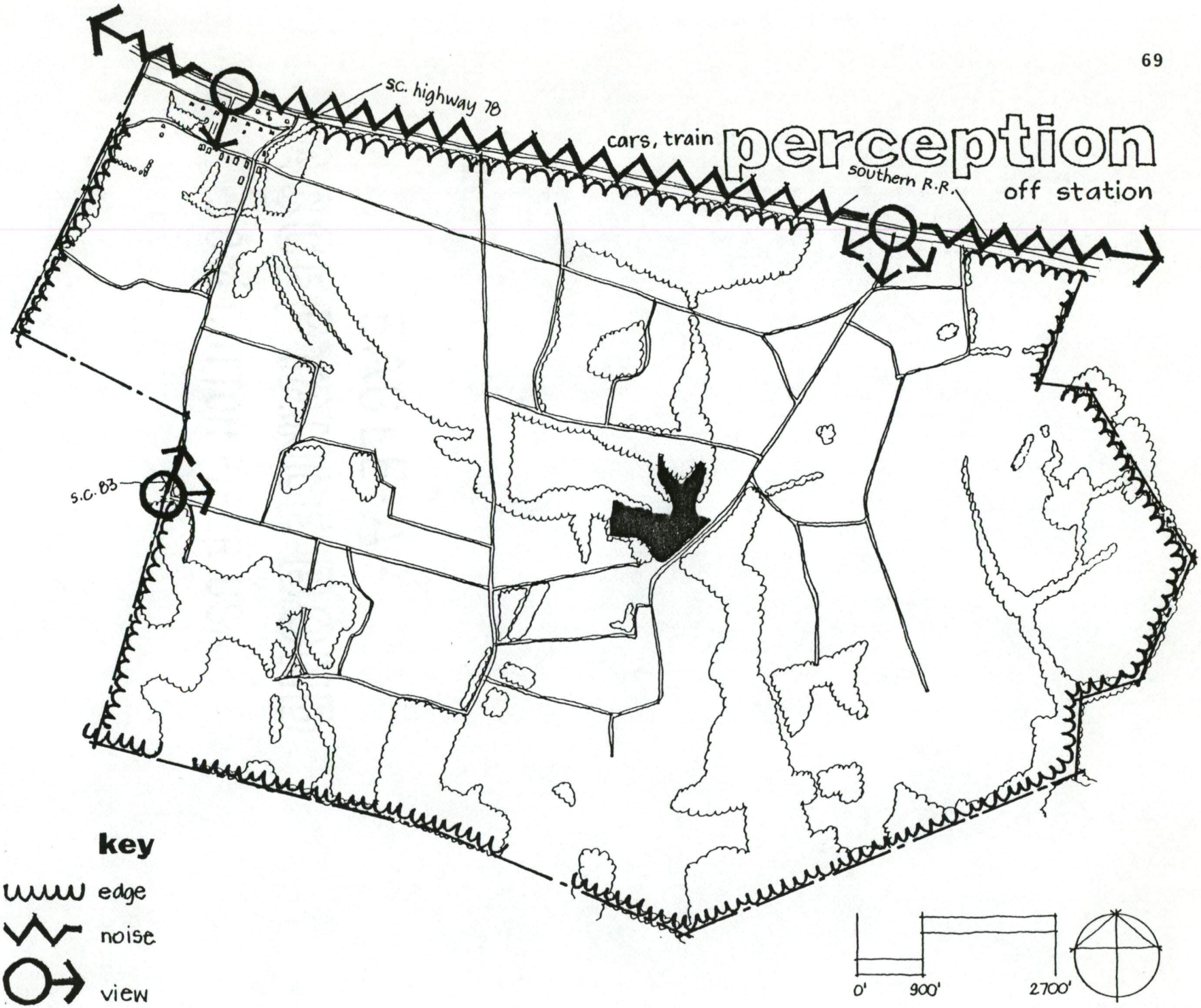

s.c. highway 78
southern R.R.
s.c. 83
crop land
poor
fair
good
prime
0'
900'
2700'

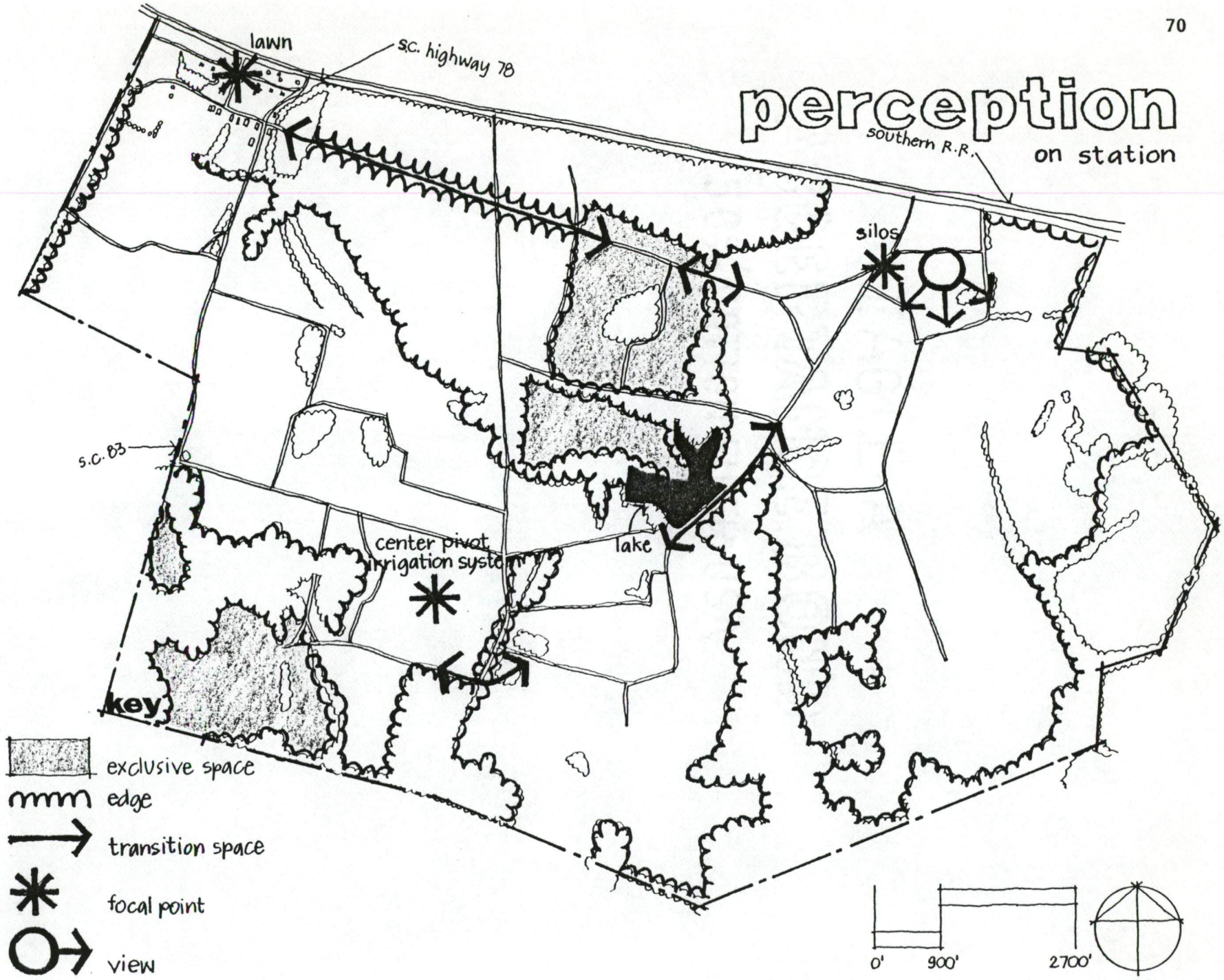
The wide variety of soil types on the Edisto Station are a valuable resource in comparing soil characteristics and its affect on plant growth to the farms in the region. Different surface soil types on the station influence crop and cattle areas, and building locations. The soil analysis consists of identifying and describing each soil type, and analyzing each for its crop, pasture, and building value.

CHARACTERISTICS OF SOILS AFFECTING USE	CROPS	PASTURE	BUILDINGS
1. Ailey well drained upland sandy soil with slow surface runoff	good	fair	fair
2. Ardilla deep, poorly drained soil with surface saturated in winter/spring with slow runoff	good	good	poor
3. Craven well drained soil on level to sloping land with rapid surface runoff	good	good	poor
4. Dothan loamy sand	good	good	fair
5. Dunbar deep, poorly drained upland soil with slow surface runoff	good	good	poor
6. Fuquay deep, well drained upland soil with slow surface runoff	good	fair	fair
7. Gilead well drained clay on level to moderate sloping land with moderate to rapid surface runoff	fair	good	poor
8. Grady poorly drained upland soil in depressions with surface saturated in winter/spring with slow runoff	poor	poor	poor

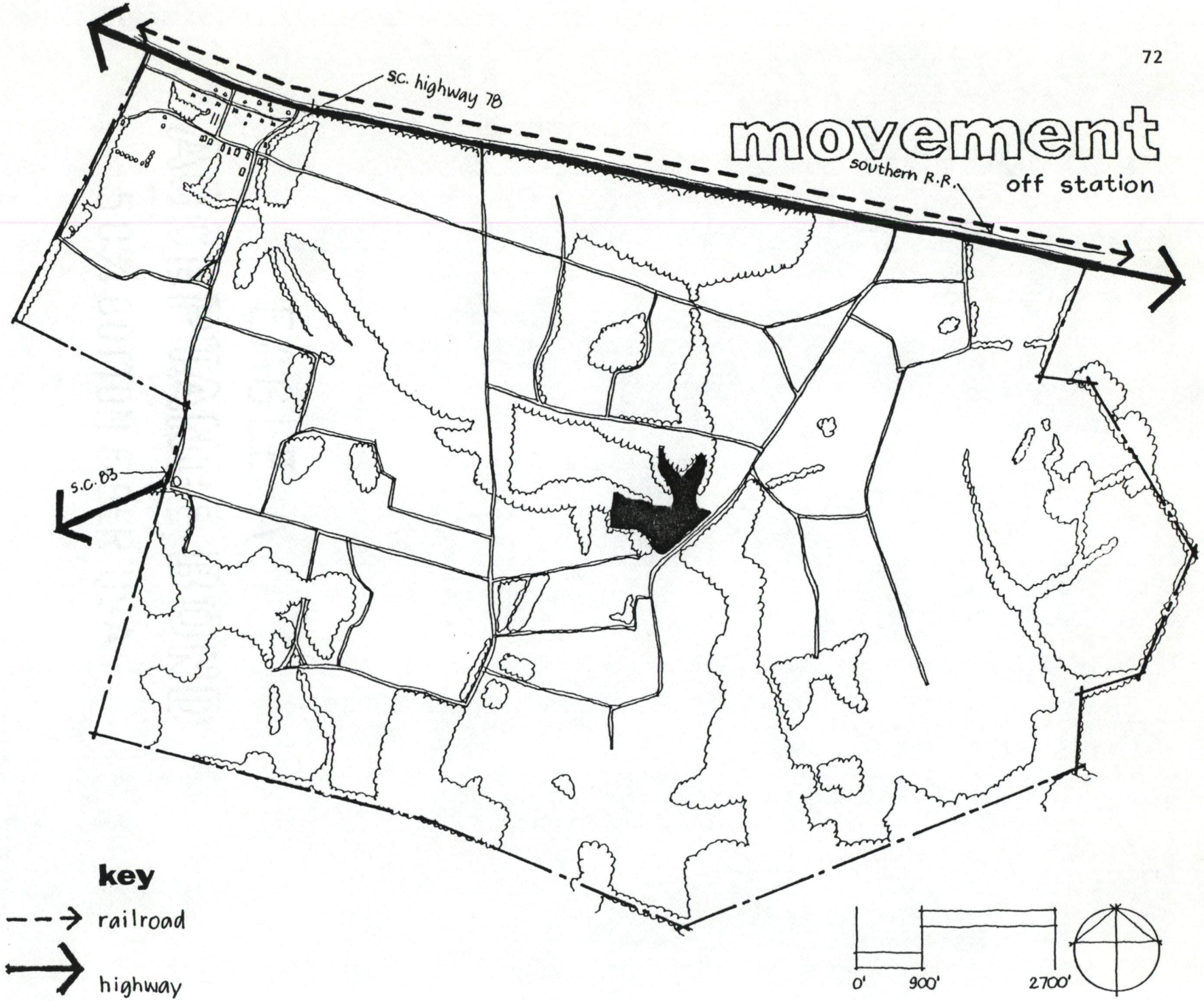
CHARACTERISTICS OF SOILS AFFECTING USE	CROPS	PASTURE	BUILDINGS
9. Johnston deep, very poorly drained soil with slow surface runoff	poor	poor	poor
10. Lakeland excessively drained, deep sand with slow surface runoff	fair	fair	good
11. Marlboro well drained upland soil with medium surface runoff	good	good	fair
12. McColl poorly drained on level or concave land with surface saturated in winter/spring with ponded surface runoff	poor	poor	poor
13. Ochlockonee deep well drained soil on flood plains with slow surface runoff	good	good	poor
14. Orangeburg deep well drained soil on level to sloping land with medium surface runoff	good	good	good
15. Plummer poorly drained soil on depressions, low areas with slow, ponding runoff	poor	poor	poor
16. Rembert deep, poorly drained soil with slow and ponding surface runoff	poor	poor	poor
17. Troup deep, well drained soil on slight to moderate slopes with slow surface runoff	fair	good	good

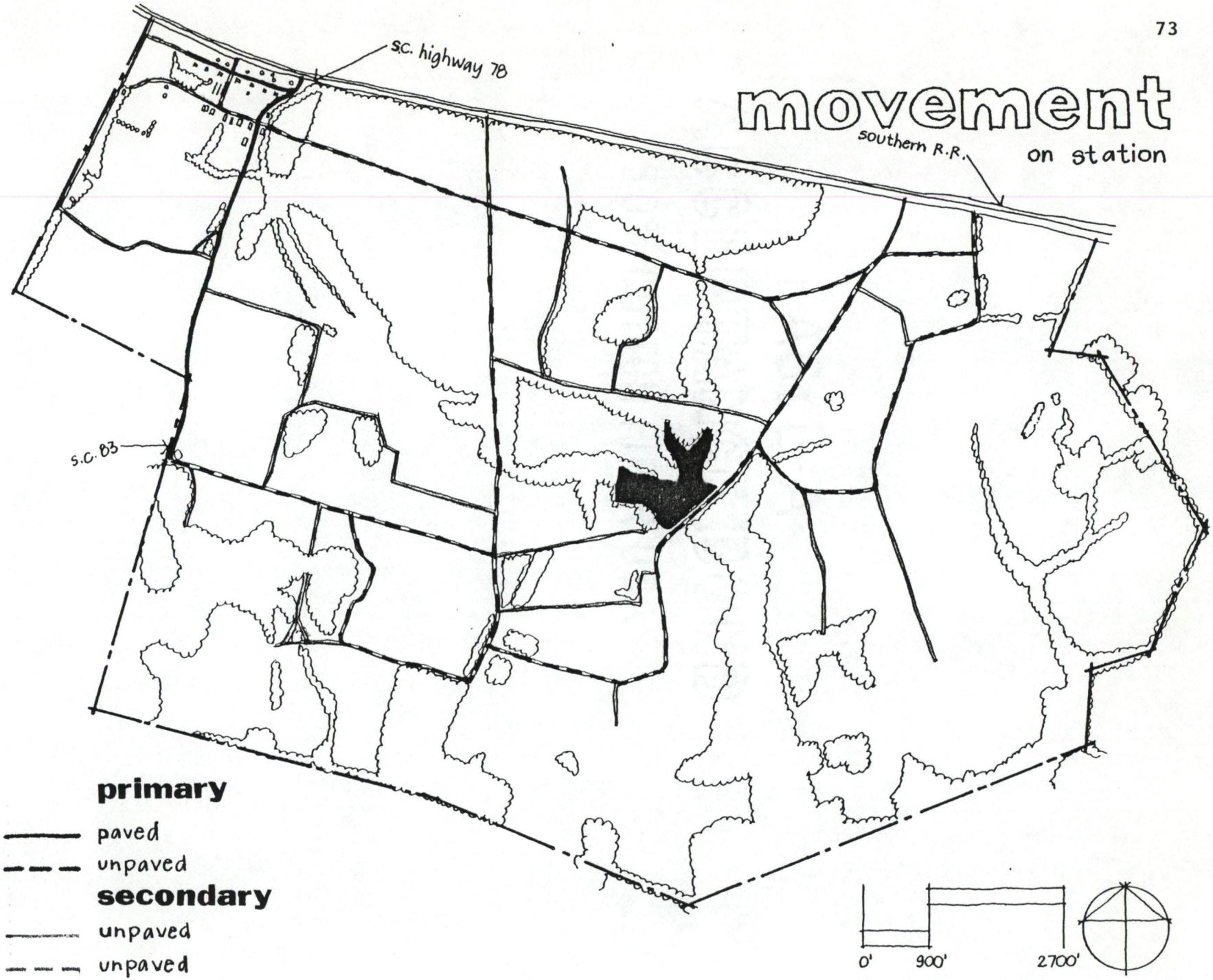
CHARACTERISTICS OF SOILS AFFECTING USE	CROPS	PASTURE	BUILDINGS
18. Varina deep well drained upland soil with medium surface runoff	fair	good	fair
19. Vaucluse well drained upland soil on moderately steep land with medium runoff	poor	good	fair
20. Wagram deep, well drained on slight slopes with slow surface runoff	fair	good	good


S.C. highway 78
cars, train
perception
southern R.R.
off station
S.C. 83
key
edge
noise
view
0'
900'
2700'

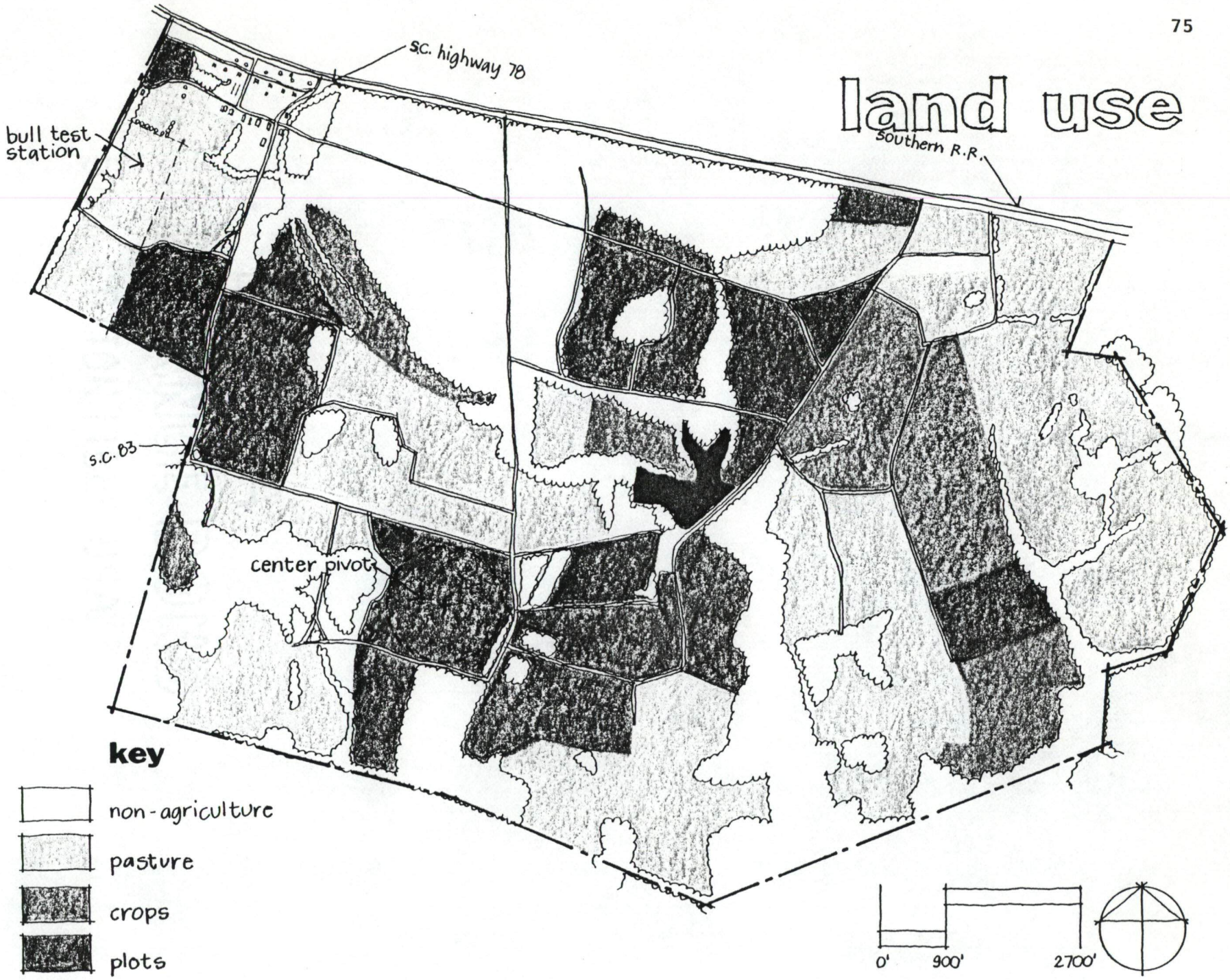

perception
on station
lawn
s.c. highway 78
southern R.R.
silos
s.c. 83
center pivot irrigation system
lake
key
exclusive space
edge
transition space
focal point
view
0'
900'
2700'

Important visual perception factors include good entry views, well defined station boundaries, and noise sources from off the station. On the station, well defined land areas, focal points such as the silos, lake, and center pivot irrigation system, movement transition areas, and good views, influence the perception of the station as a whole.


movement
S.C. highway 78
southern R.R.
off station
S.C. 83
key
railroad
highway
0'
900'
2700'

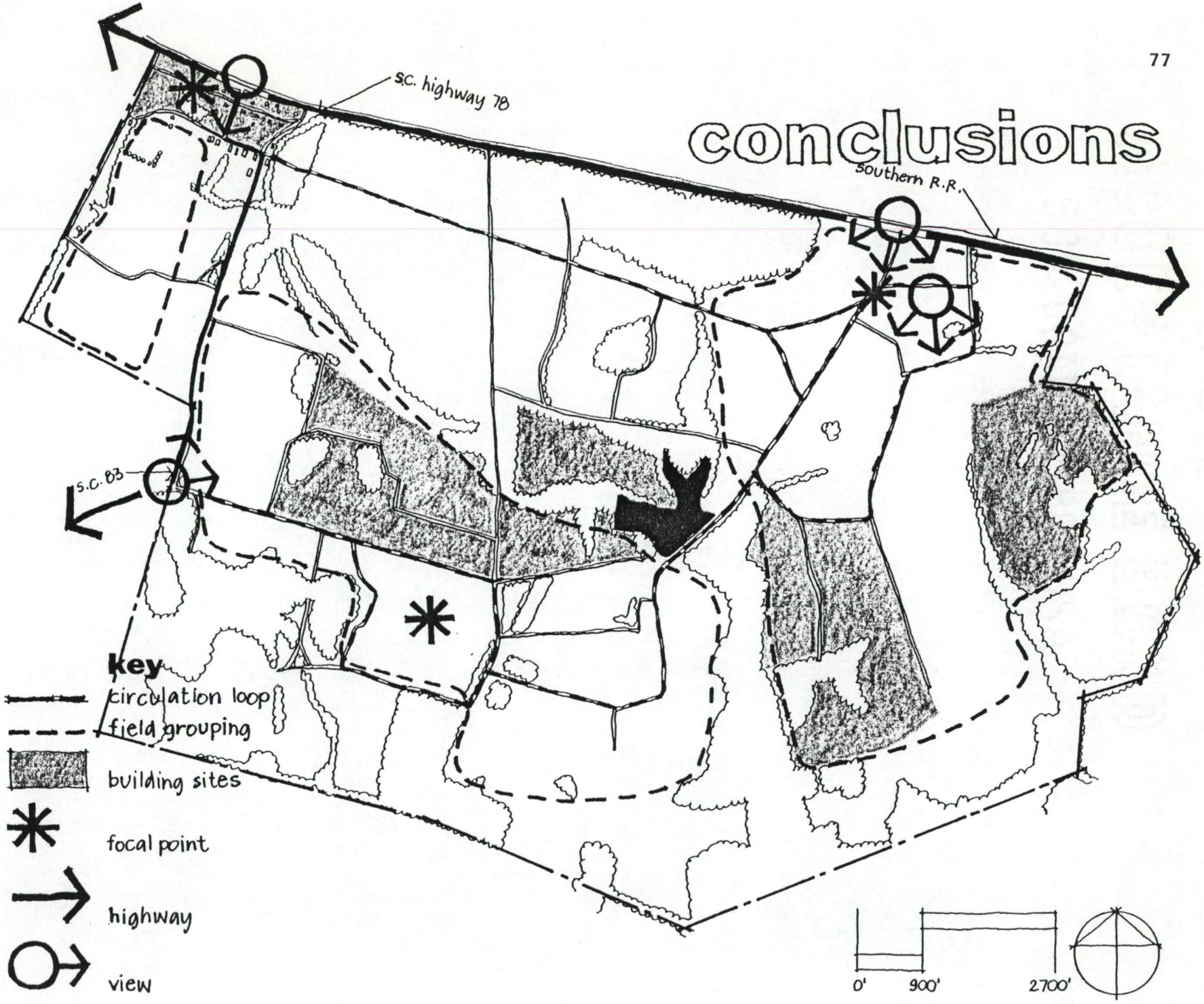

movement
on station
S.C. highway 78
southern R.R.
S.C. 83
primary
paved
unpaved
secondary
unpaved
unpaved
0'
900'
2700'

Highway 78 on the north boundary is the primary road connecting the station to Williston and Aiken to the west, and Blackville to the east. A Southern Rail Line is adjacent to Highway 78. S.C. 83 is a secondary road passing through the west corner of the station and linking Highway 78 with Barnwell to the south. Within the station the circulation system consists of paved roads around the existing station buildings and unpaved roads leading to the station field areas. A loop road connects all the major field areas on the station and secondary roads branch off into separate fields.


land use
S.C. highway 78
bull test station
Southern R.R.
S.C. 83
center pivot
key
non-agriculture
pasture
crops
plots
0'
900'
2700'

A land use analysis reveals four major uses of station property: plots, crops, pasture, and non-agriculture. Plot land consists of planting areas divided into smaller areas for specific crops. Crop land consists of general planting areas. These lands are rotated every year. The pasture land is either part of specific cattle areas, hay or grain fields, or general grazing land. The non-agriculture land either has buildings on it or is not in use.

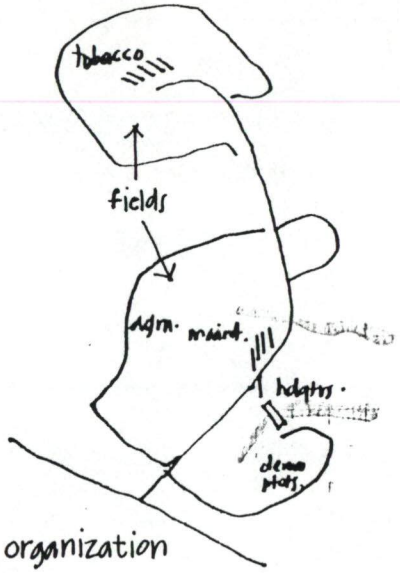
conclusions



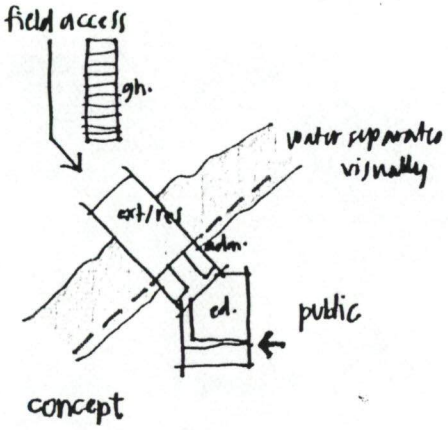
The conclusions from the site analysis indicate that building locations would be determined primarily by soil types, existing land use, and a station circulation system. The soil analysis revealed several potential buildings areas that are neither prime crop nor pasture land, and by comparing these with existing land use, four building locations result. Comparing these four locations with movement systems analysis indicates that the optimum building location is in the center of the station near the lake. This area has soil types which are best suited for general grazing or for buildings, with the land currently being used for pasture. A location in the center of the station is advantageous for efficient access to all station lands. The area is adjacent to a lake which could be an attractive amenity for a building complex.

Case Studies

The purpose of case studies is to investigate alternative solutions to design problems similar to the Edisto Experiment Station. They are a valuable tool to broaden the perspective of the project, develop organizational concepts, and study specific design responses to particular requirements. The case studies examined for the Edisto Station are the Pee Dee Research and Education Center, the Boyce Thompson Institute for Plant Research, and the Concordia Senior College.



organization



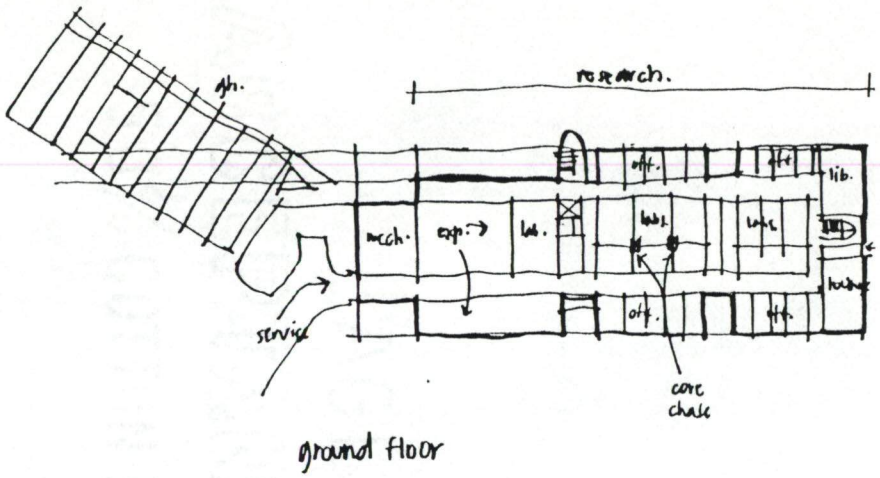
concept

PEE DEE RESEARCH AND EDUCATION CENTER (PDREC)

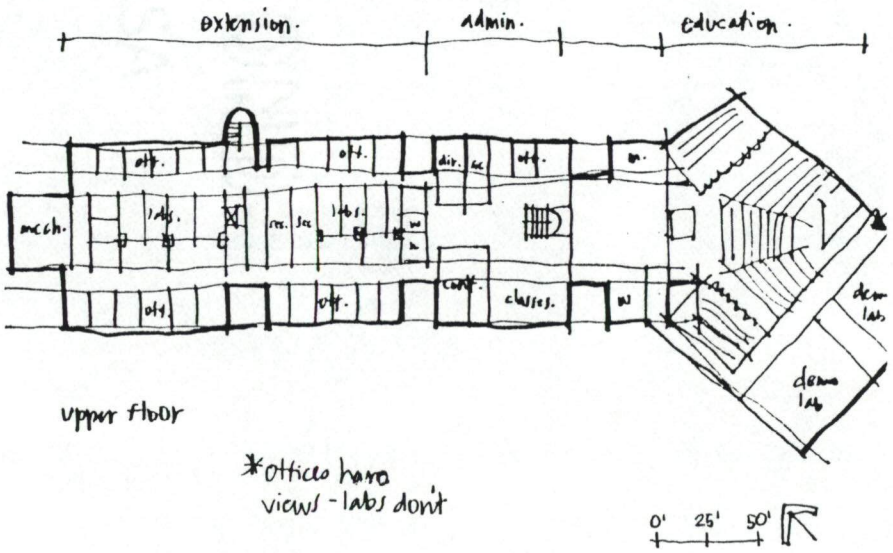
Location: outside Florence, S.C.
Architect: Wilkins and Wood, Architects
Date: currently under construction
Purpose: A S.C. Agricultural Experiment Station for the northeast region of South Carolina.

The PDREC is an appropriate case study because it is an agricultural experiment station of approximately the same scale and functions as the Edisto Station. The principal difference between them is that the PDREC is a totally new center, on a new site, while the Edisto Station is to be built on an established site.

The overall organization of the Pee Dee Station is an important example for the Edisto Station. The research center is the public and private focus, while the fields are linked to the center by equipment storage and laboratory sub-centers. The research center spans a river that divides the public parking and demonstration plots



ground floor



upper floor

*offices have views - labs don't

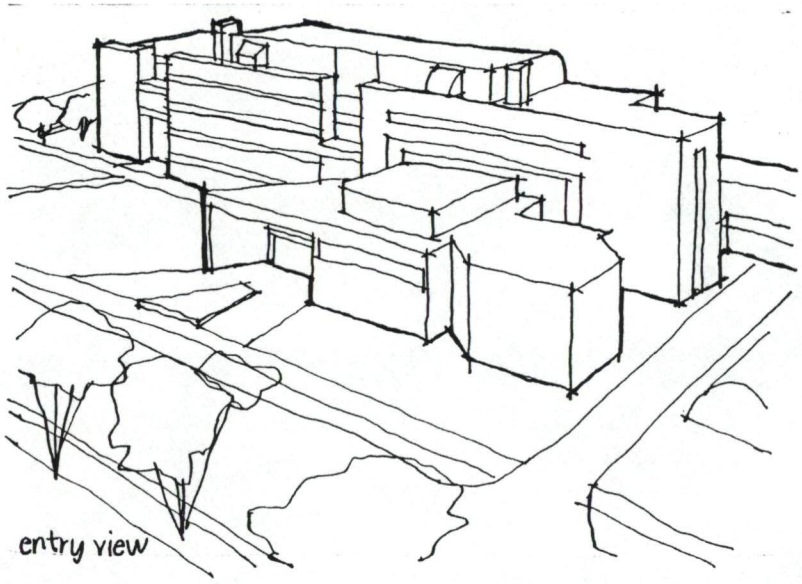
on one side from the private research greenhouses and fields on the other.

The building is organized with public spaces on the main level and private areas below. The research and extension offices are located on the exterior of the building to take advantage of views and natural light, while the laboratories are in the center.[24]

The Pee Dee Station plan of the research center as the link between public and private areas and the fields grouped around sub-centers is a strong example for the development of the Edisto Station.

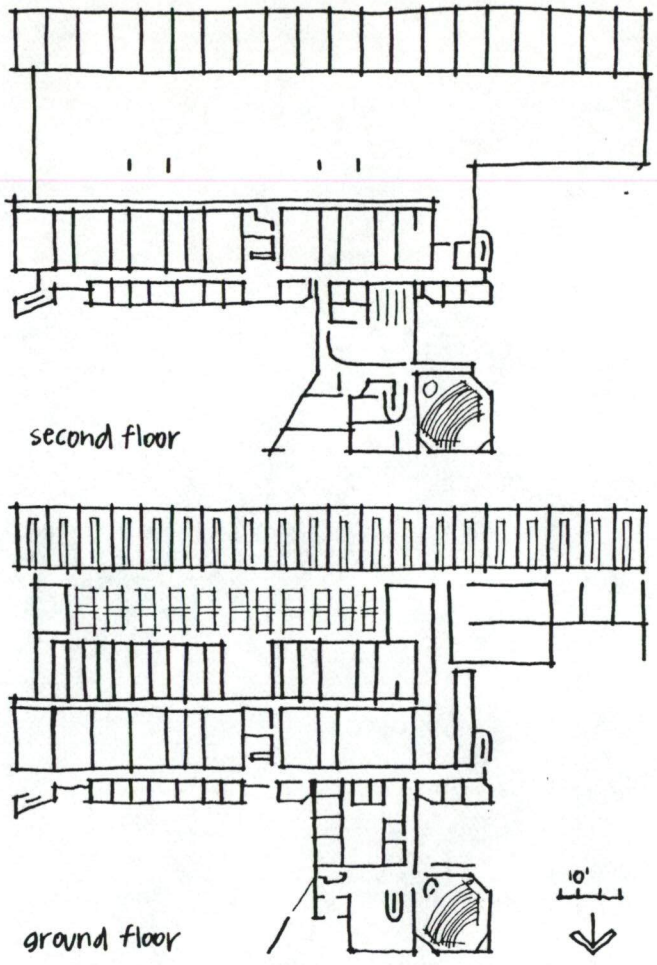
BOYCE THOMPSON INSTITUTE FOR PLANT RESEARCH

Location: Cornell University, Ithaca, N.Y.
Architect: Ulrich Franzen
Date: 1975
Purpose: Spaces for classrooms, offices, administration, and research for the College of Agriculture.


entry view

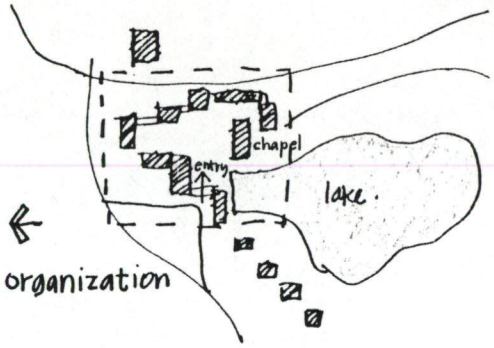
The Boyce Thompson Institute, like the Edisto Station project, is an agricultural headquarters. They each have a similar organization of public spaces and private spaces which need to interact.

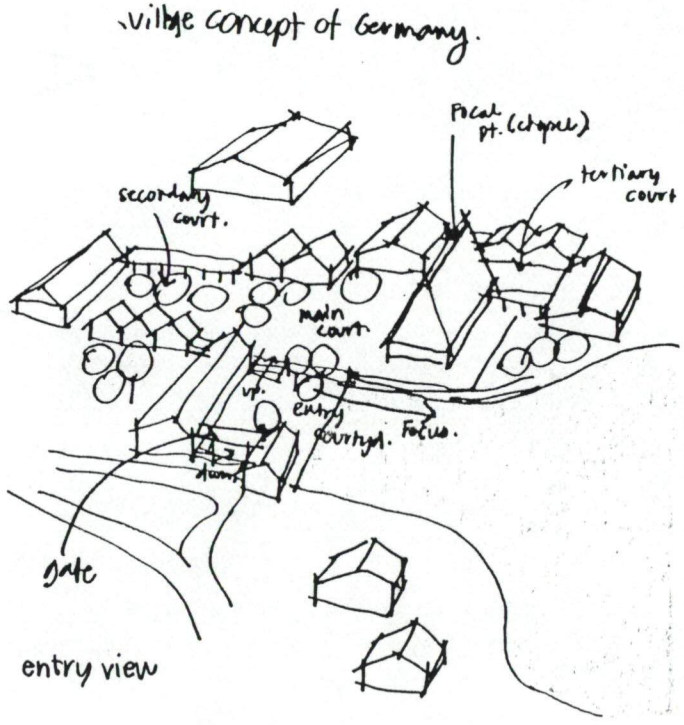
The administration and auditorium spaces of the Institute extend forward from a larger building mass to create a more human scale for the public entry. Penetrating the 4-story larger building is a public circulation spine that provides access to classrooms and professors' offices. The classrooms on the south side of the spine form a buffer to the private research spaces beyond. Within this research area there is an open work space that is adjacent to



the greenhouses permitting an efficient work flow.[25]

The expression in building form of the relationship of public and private spaces is a major design principle of the Institute for Plant Research and an apt illustration for the proposed Edisto Station Research Center.





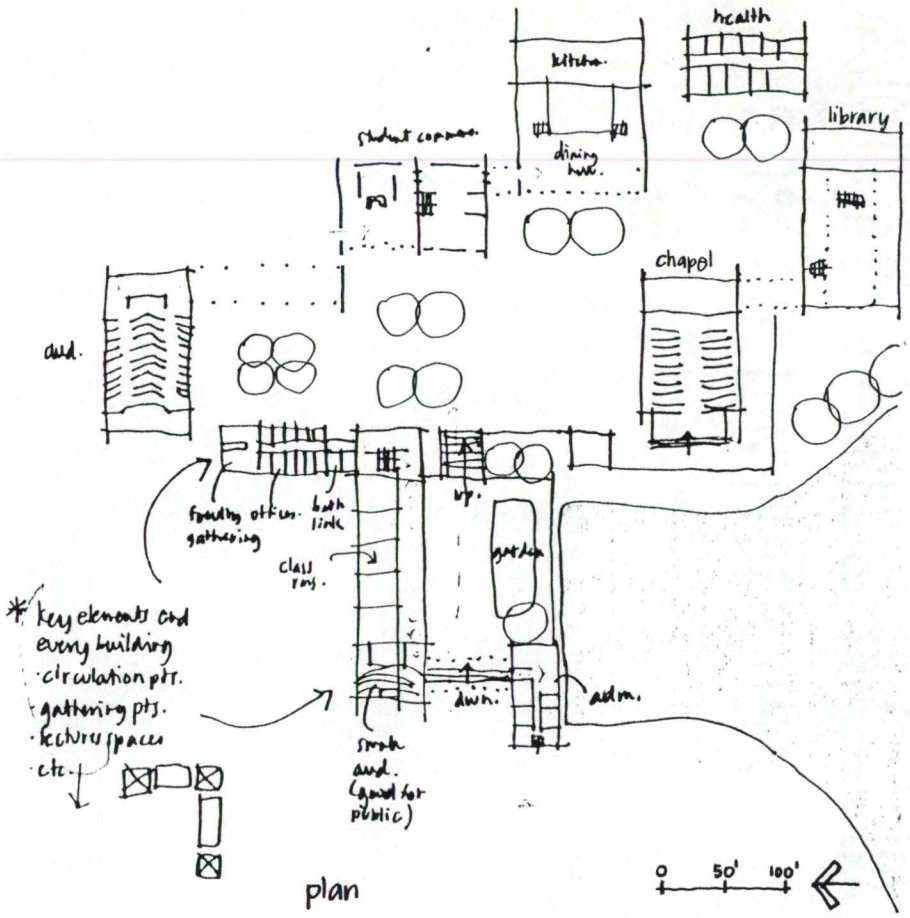
CONCORDIA SENIOR COLLEGE

Location: Fort Wayne, Indiana
Architect: Eero Saarinen and Associates
Date: 1958
Purpose: A two-year senior college for 450 students who plan to train for the Lutheran ministry.

Concordia Senior College as a complex of buildings relates to the Edisto Station Research Center. The teaching and living atmosphere of the College is different from the research emphasis of the Edisto Station, but the scope of the buildings and variety of functions is similar.

The organization of the Concordia Senior College is based on a "village concept." The community aspect of the buildings is emphasized by the pitched roofs, all of which run in the same direction, giving unity to the whole. The focus of the village is the chapel, which is on the highest spot of the campus.

The circulation system is important in defining the different activitiesof the College. The



public enters into a lower public courtyard bordered by the lake and classrooms. Offices, auditorium, dining hall, and the chapel surround the main upper courtyard, which is a more private area. There is a continuous covered path around the entire complex that further unites the different buildings.[26]

The building organization and circulation system of the Concordia Senior College is an especially important study for the Edisto Station Research Center.

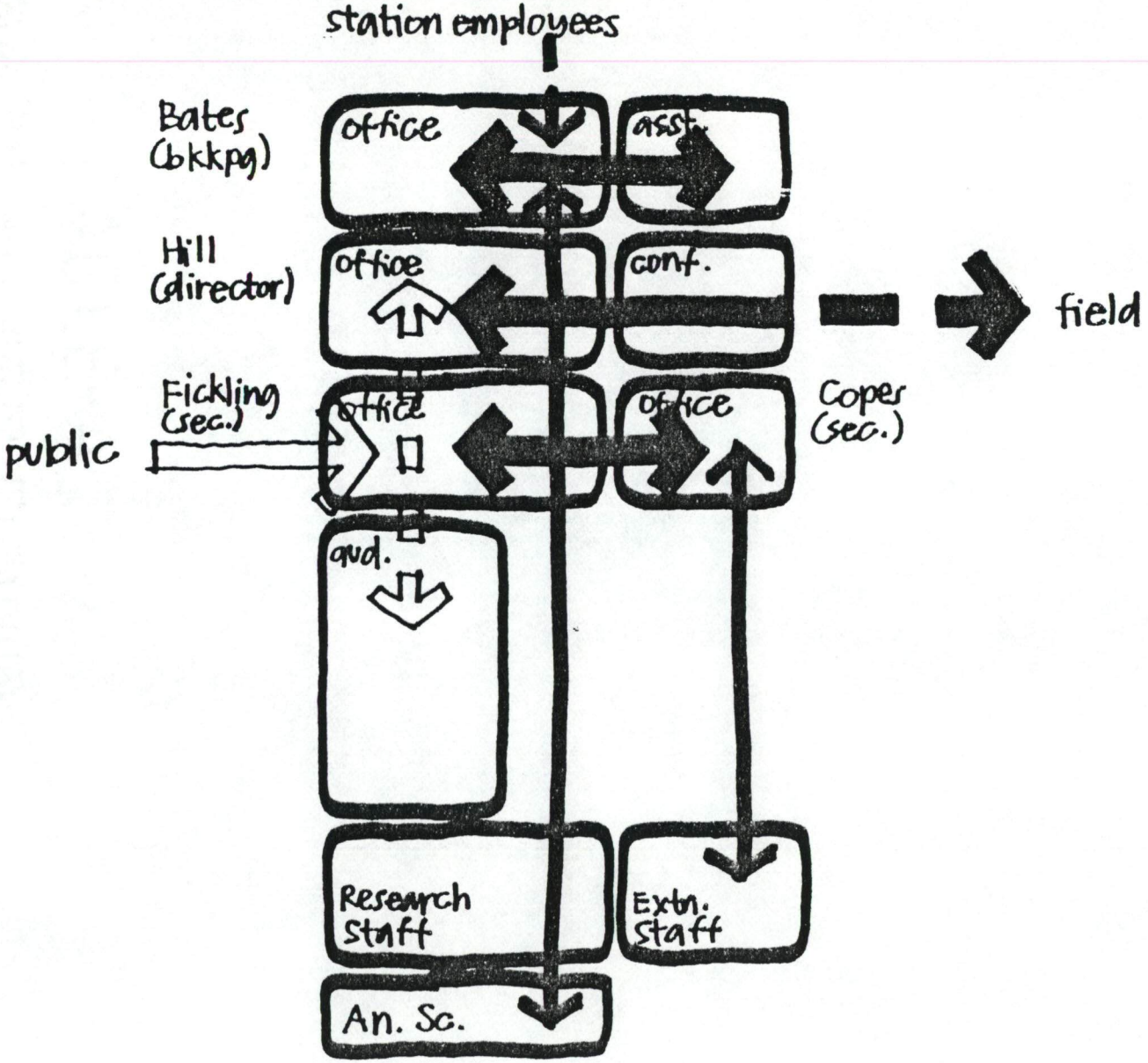
The Program

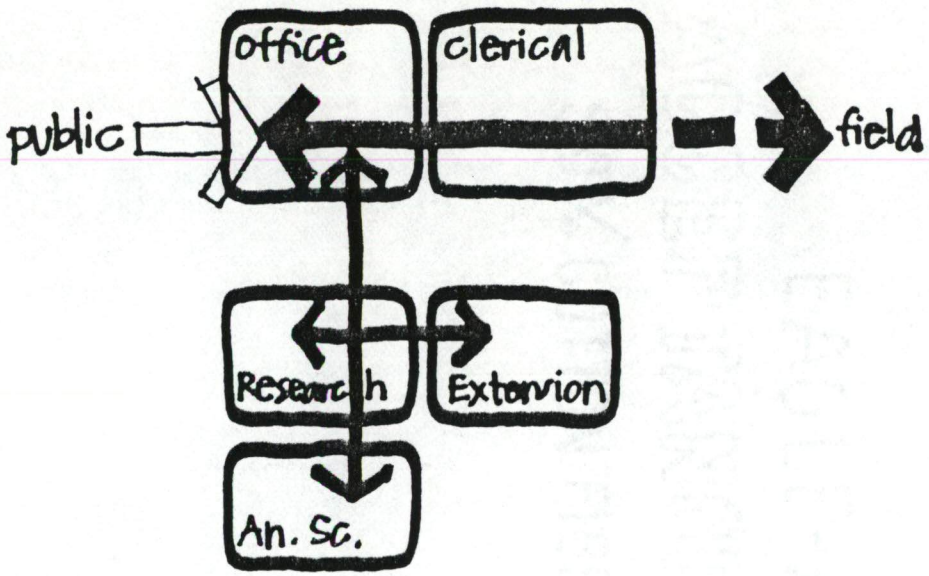
activities

A description and analysis of the building activities provides information of the building purpose, specific functions, and spatial relationships. The purpose of a new Research and Education Center at the Edisto Station is to unite the administration, extension, research, and field components. This analysis will lead to a further exploration of needs, a program of spaces, and preliminary planning studies.[27] The areas studied are administration, extension, research, and field activities.

administration

The organization of the station.





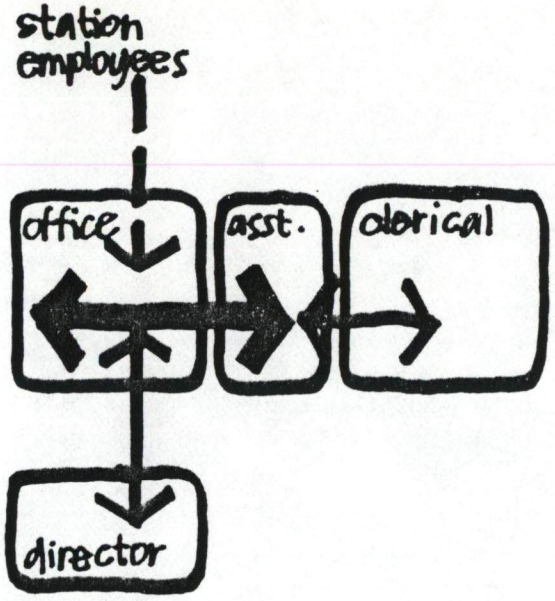
Resident Director

Dr. J. R. Hill, Jr.

Works with Director and Associate Director of Experiment Stations, Dr. Godley and Dr. Snell.

Supervises Research, Extension, and Field work at the station.

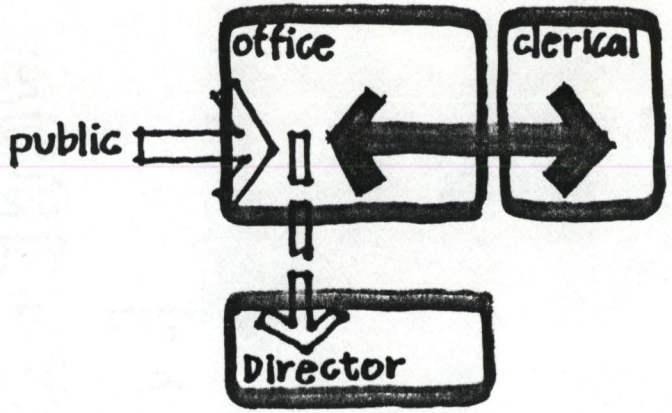
Researches beef cattle forage systems for Animal Science Department.



Bookkeeper

Mrs. Bates

Works with the Resident Director on financial records and supervises the secretaries.



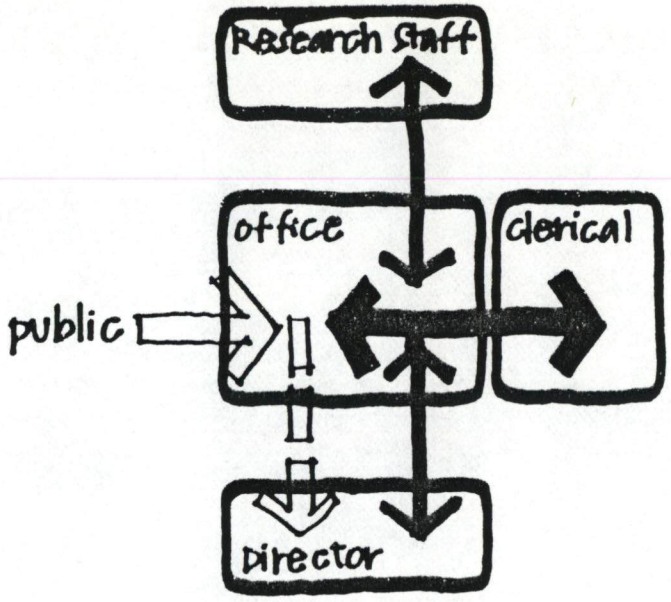
General Secretary

Serves as a receptionist and works with the Bookkeeper.

Extension Secretary

Mrs. Copes

Works for the Extension staff and Bookkeeper.



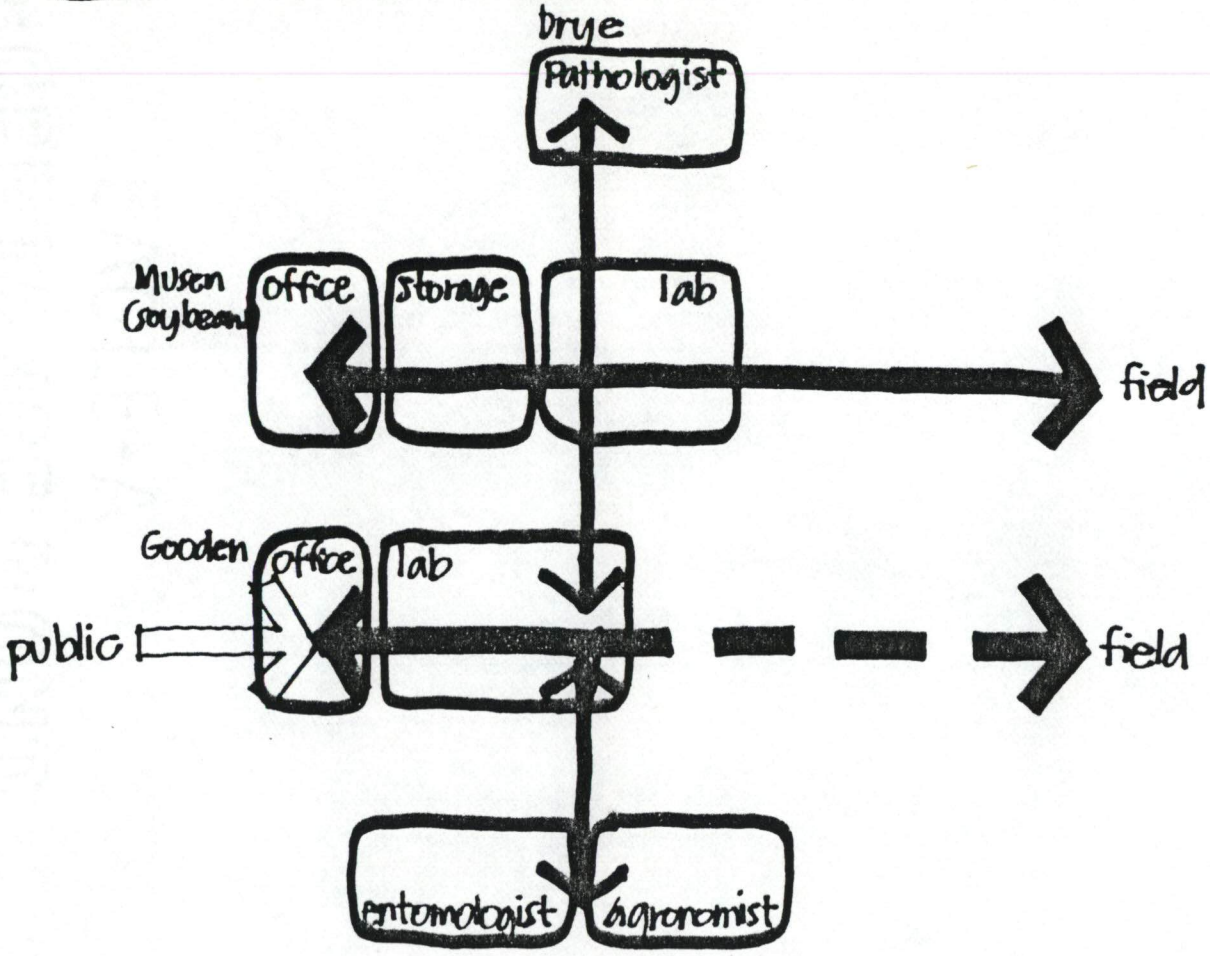
Research Secretary

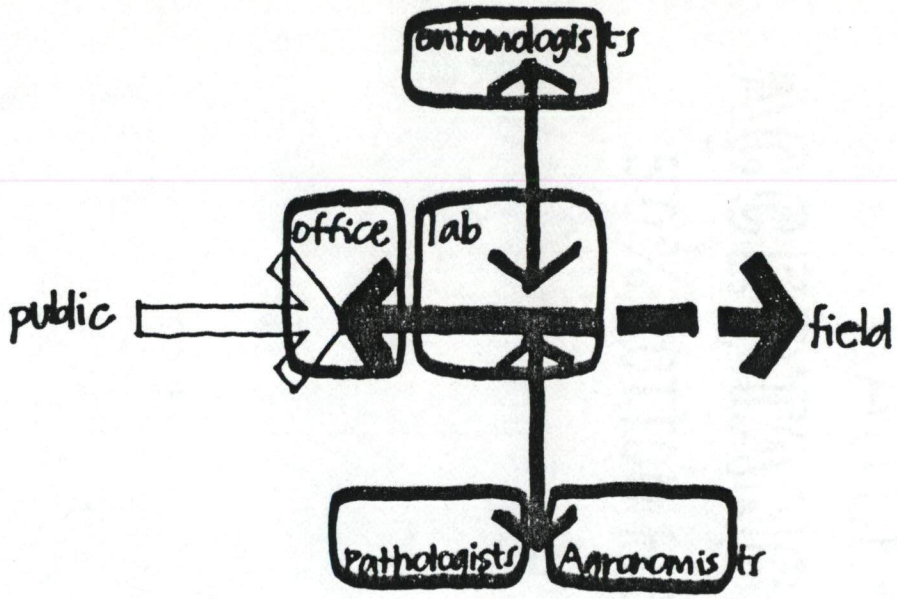
Mrs. Fickling

Works for the Research staff and with the Resident Director.

agronomy

The study of field crops and soil interaction.





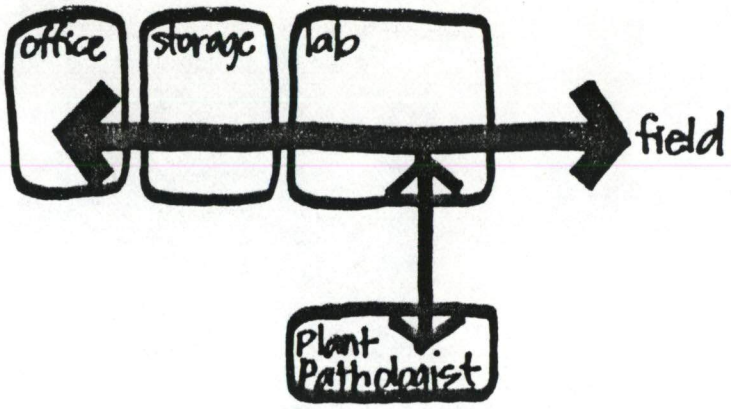
Extension Scientist

Dr. D. T. Gooden

Works in office conducting phone conversations with farmers and county agents.

Researches soybeans and peanuts using laboratory. Works with Entomology and Plant Pathology.

Conducts demonstrations for area farmers both on and off the station.



Research Scientist

Dr. H. L. Musen

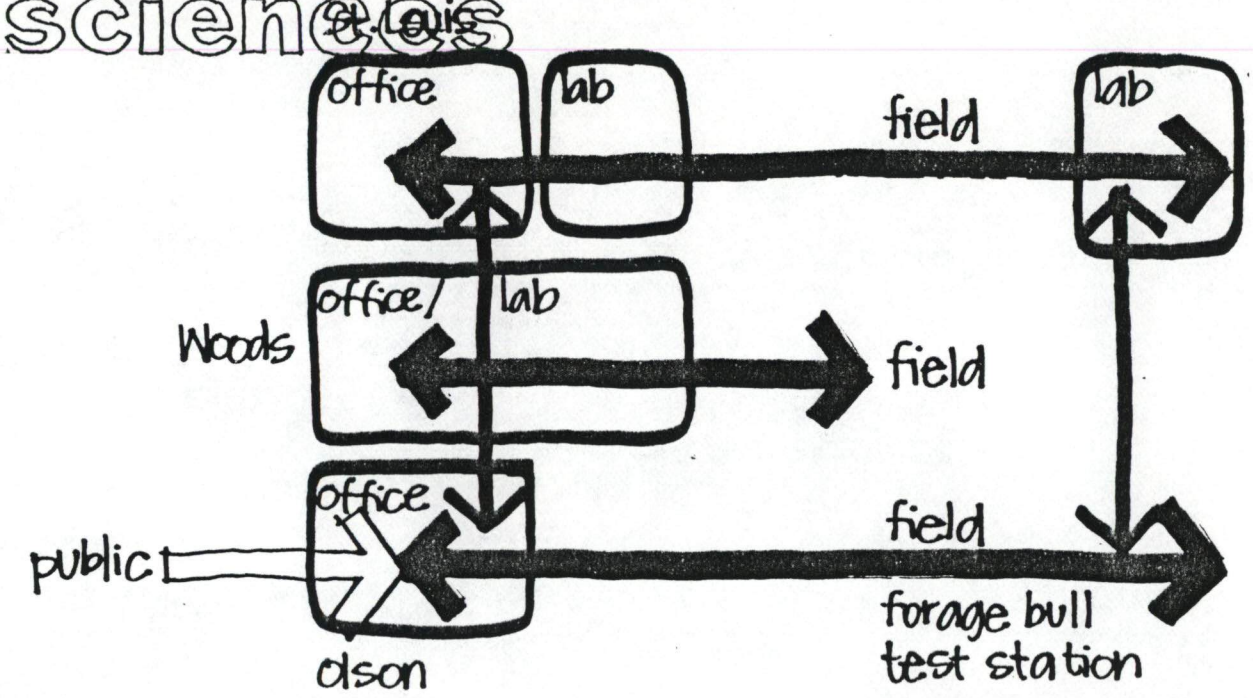
Works in office on soybean research records.

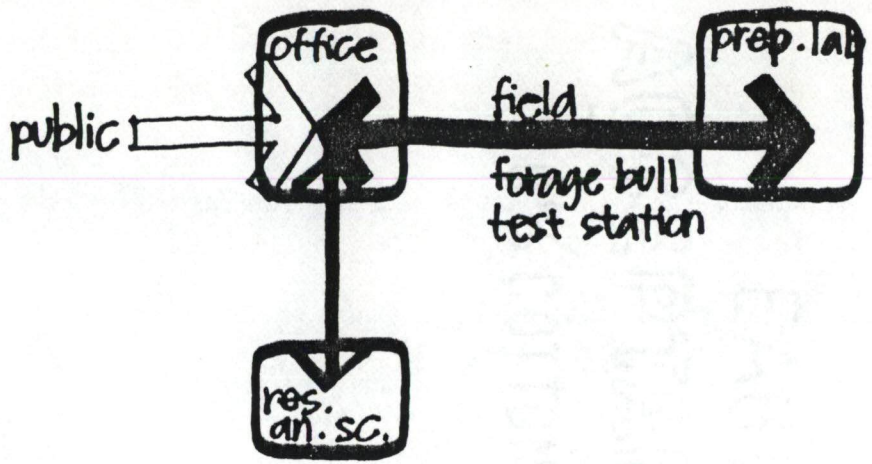
Researches soybeans using laboratory and storage for seed preparation and nematode studies. Works with Plant Pathology.

Manages soybean growth and harvesting in fields.

animal sciences

The study of production and processing of livestock.



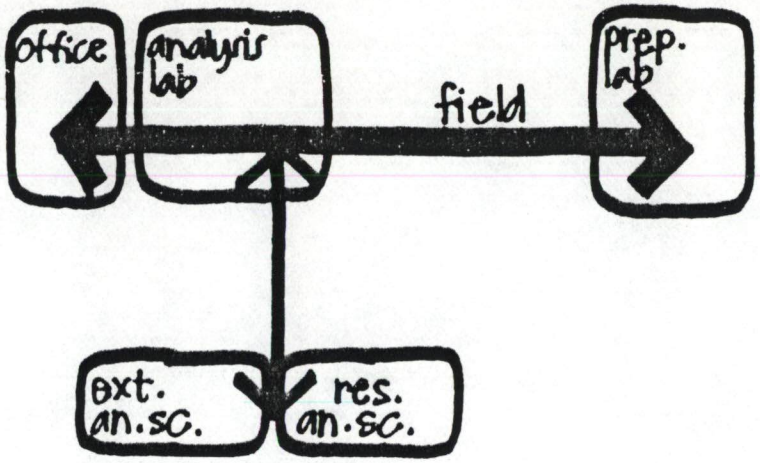


Extension Scientist

Dr. L. W. Olson

Works in office and on computer on beef cattle reports.

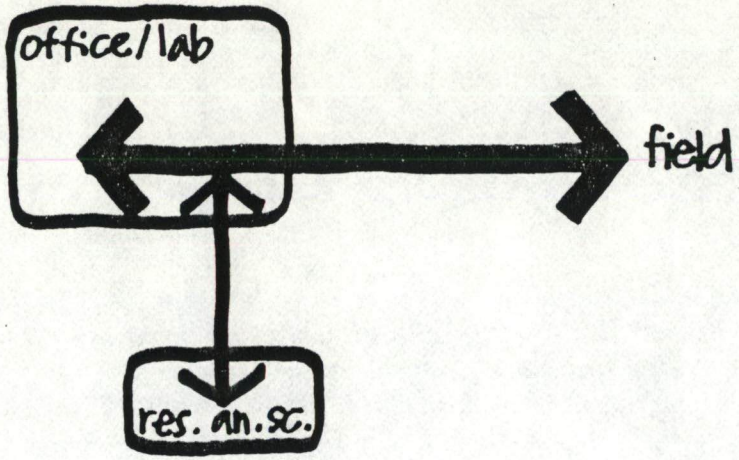
Conducts beef cattle production and forage bull test station in field, and demonstratings both on and off the station.



Research Scientist

Dr. D. G. St. Louis

Works in office on beef cattle forage studies. Researches feed quality in laboratory. Prepares forage in field.



Research Scientist

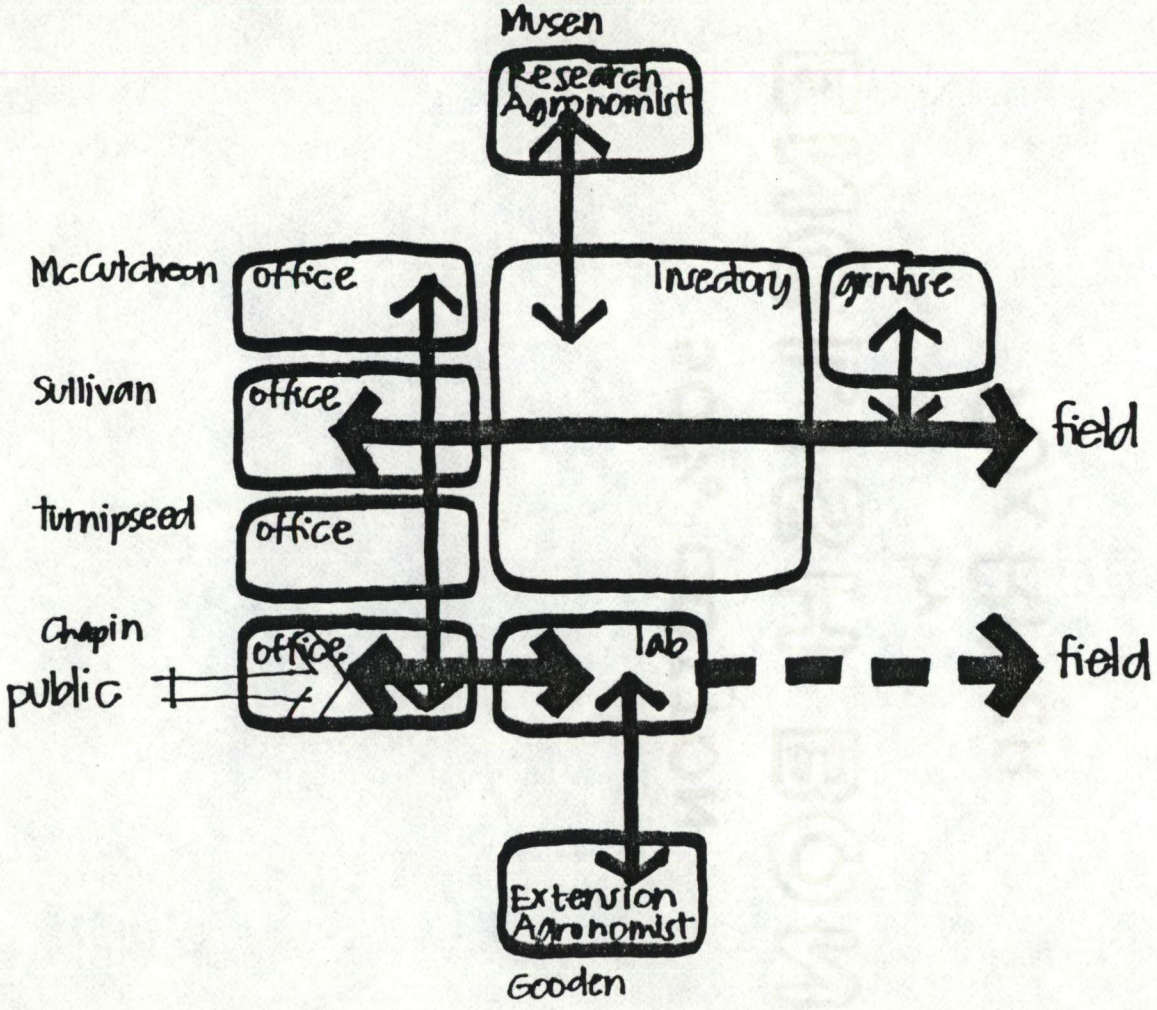
Mr. S. G. Woods

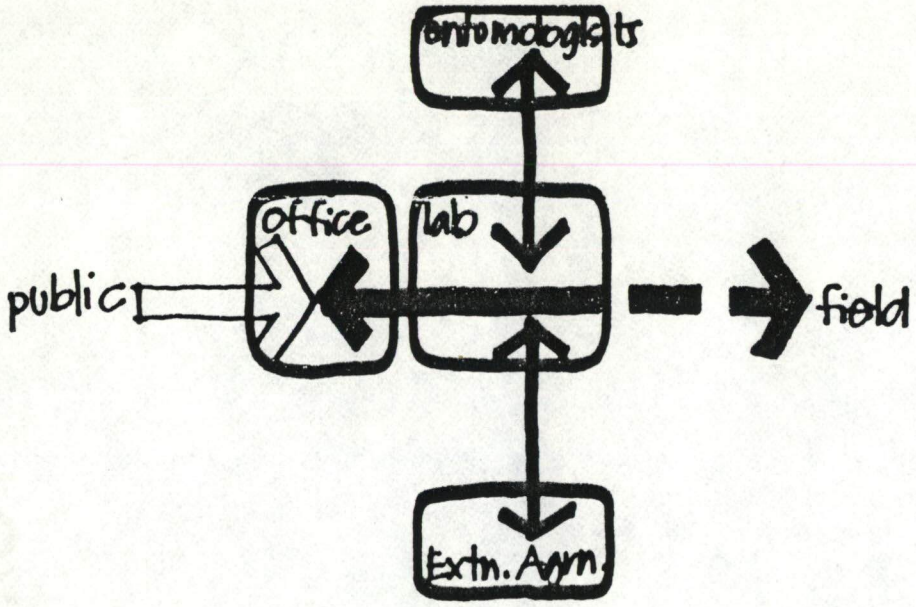
Records beef cattle management studies in office.

Prepares medicines in laboratory. Breeds and cares for beef cattle in fields.

entomology

The study of the biology and control of insects.





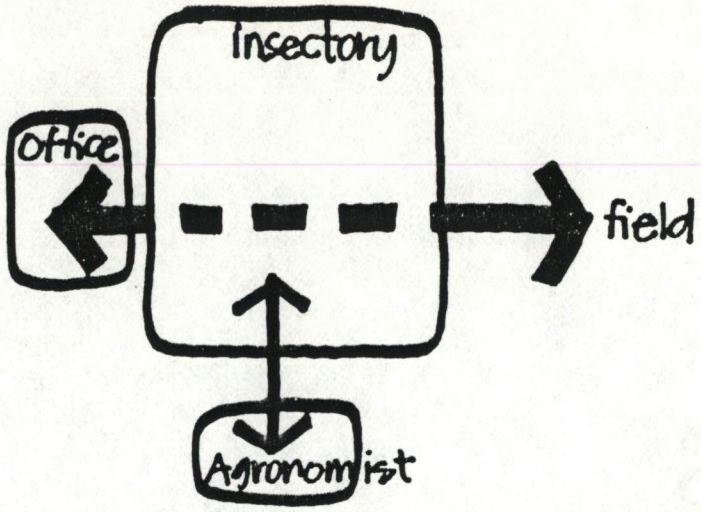
Extension Scientist

Dr. J. W. Chapin

Works in office with microscope and conducting phone conversations with farmers and county agents.

Analyzes insects and studies with computer in laboratory. Works with Agronomy.

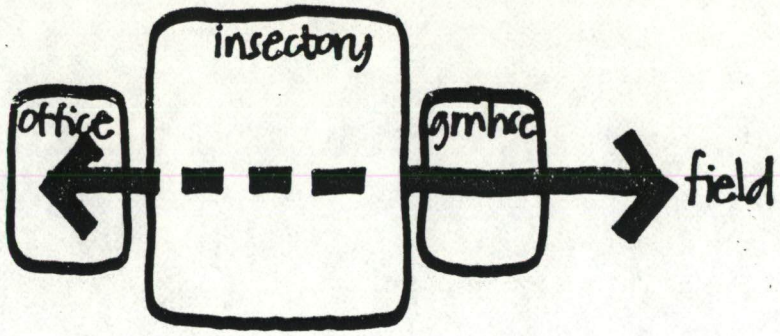
Conducts demonstrations for area farmers both on and off the station.



Research Scientist

Dr. G. S. McCutcheon

Works in office on insect studies. Researches insects in insectory. Collects specimens in field.

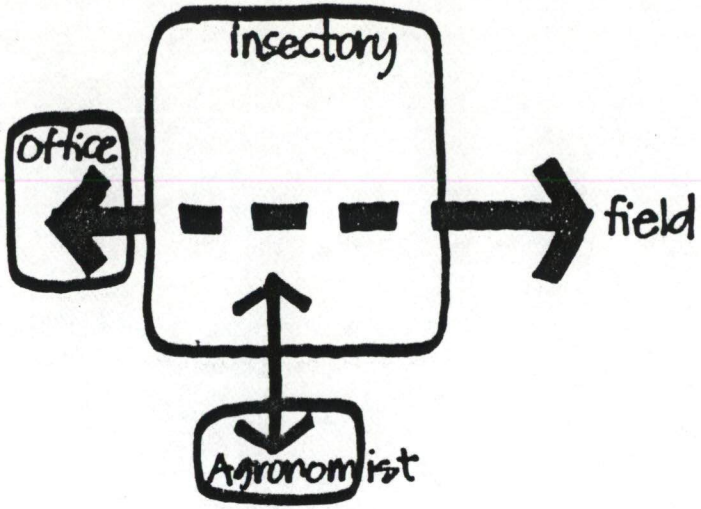


Research Scientist

Dr. M. J. Sullivan

Works in office on insect studies.

Develops resistant plant varieties and tests insecticides in insectory and greenhouse.

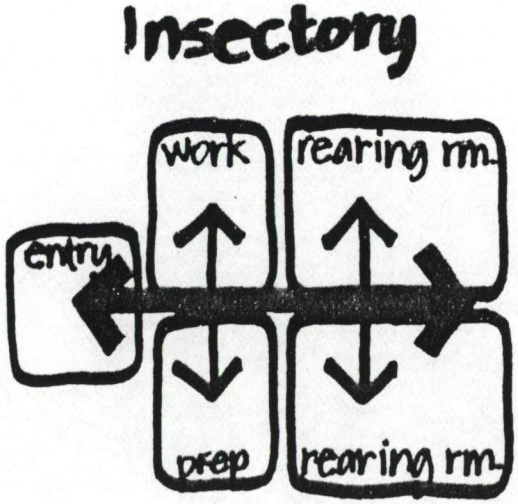


Research Scientist

Dr. S. G. Turnipseed

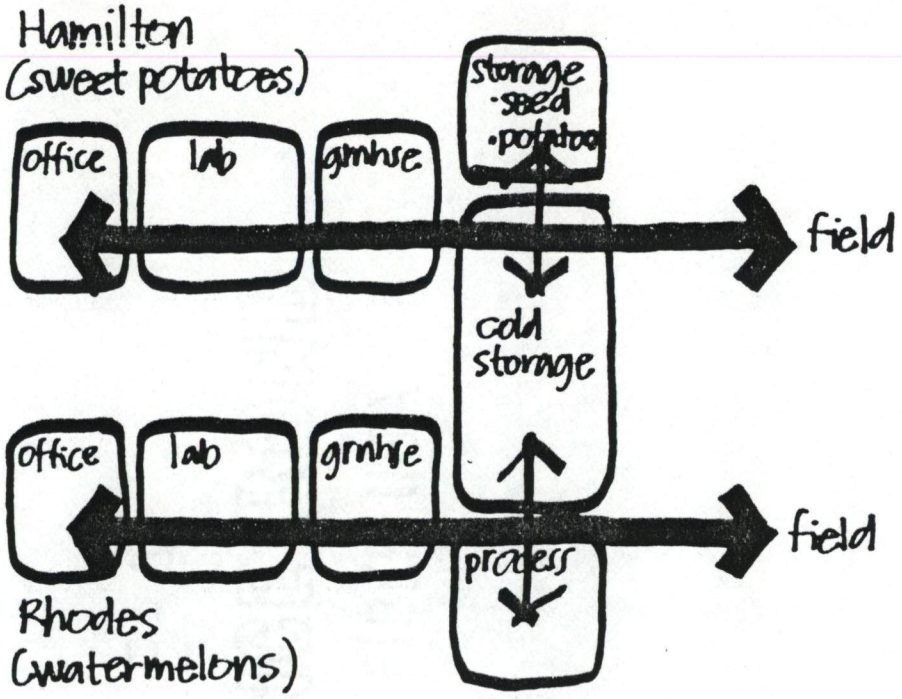
Works on insect records in office.

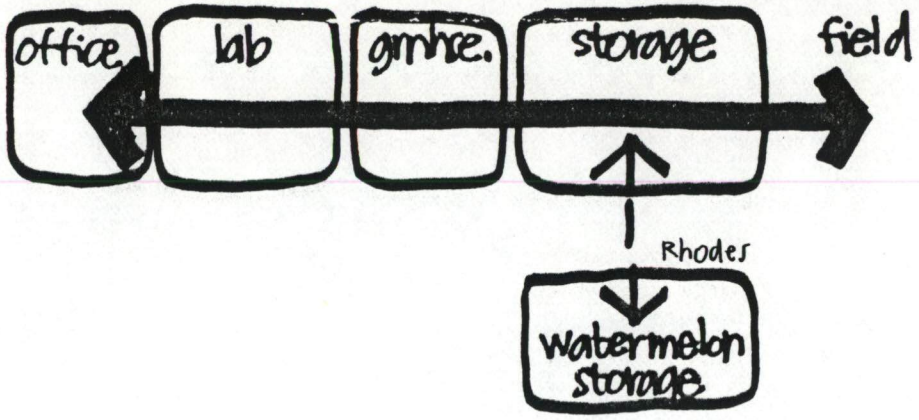
Studies effects of insects on soybeans and use of predators in insectory. Works with Agronomy.



horticulture

The study of production and processing of vegetables and fruits.





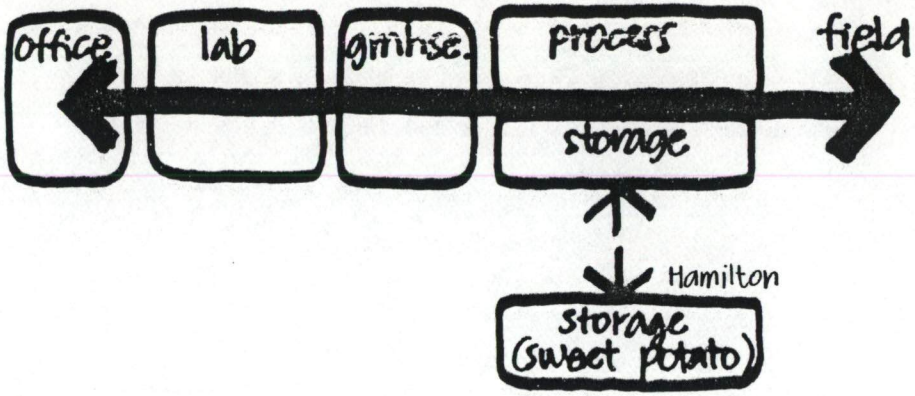
Research Scientist

Dr. M. G. Hamilton

Records sweet potato information in office.

Processes sweet potatoes and analyzes with microscope in laboratory. Develops plants in greenhouse. Stores potatoes in storage.

Manages growth of sweet potatoes in fields.



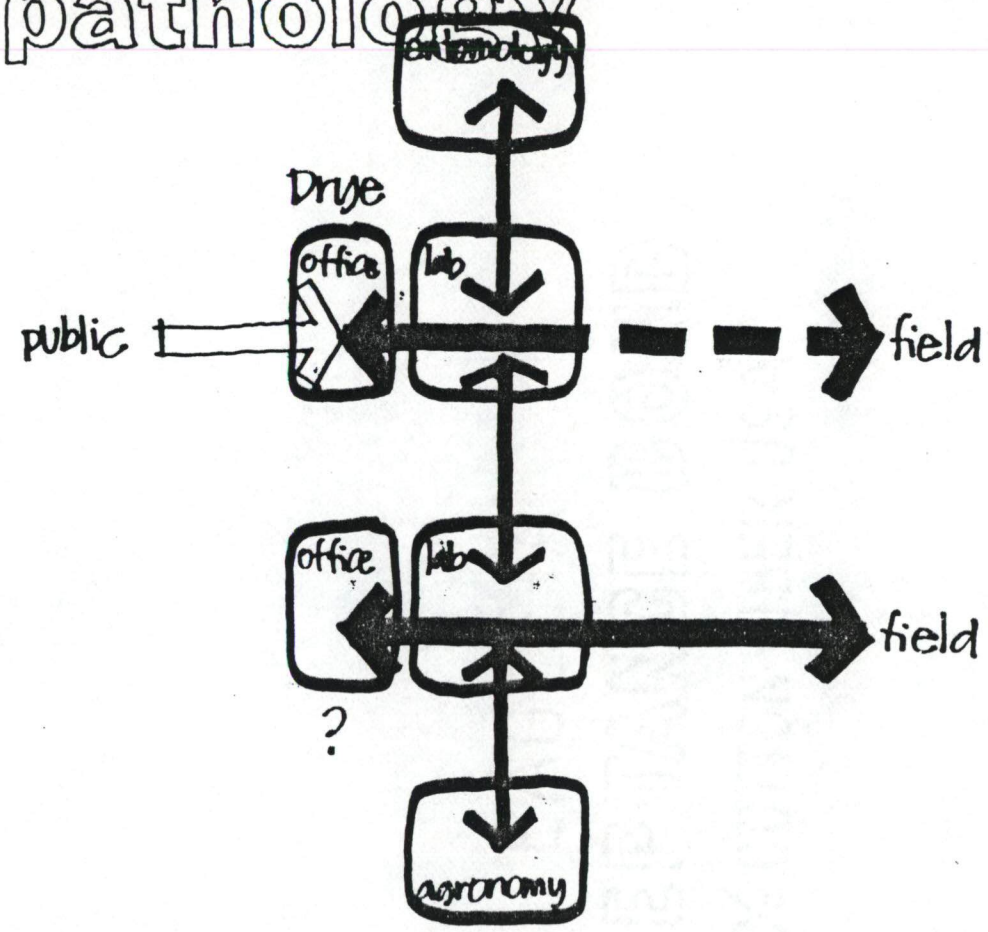
Research Scientist

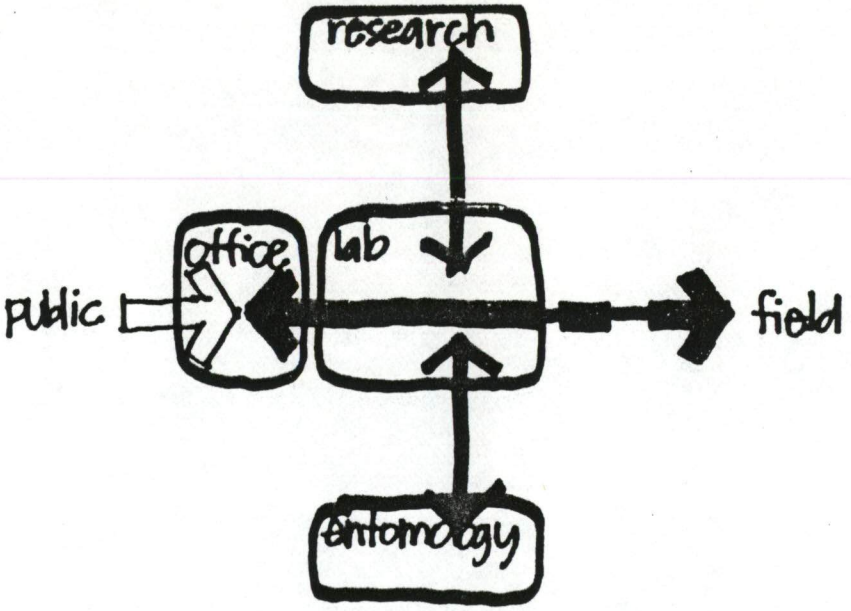
Dr. B. B. Rhodes

Works in office on watermelon studies. Analyzes watermelons and seeds in laboratory. Develops plants in greenhouse. Stores and processes watermelon and seeds in storage. Manages watermelon growth in fields.

plant pathology

The study of the nature and control of plant diseases.





Extension Scientist

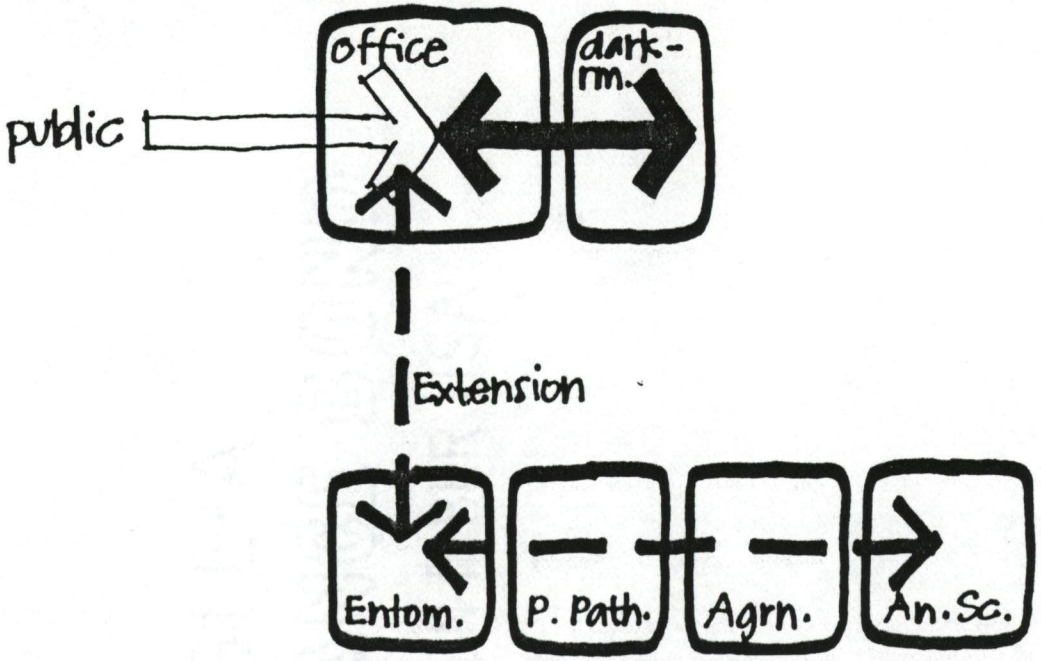
Dr. C. E. Drye

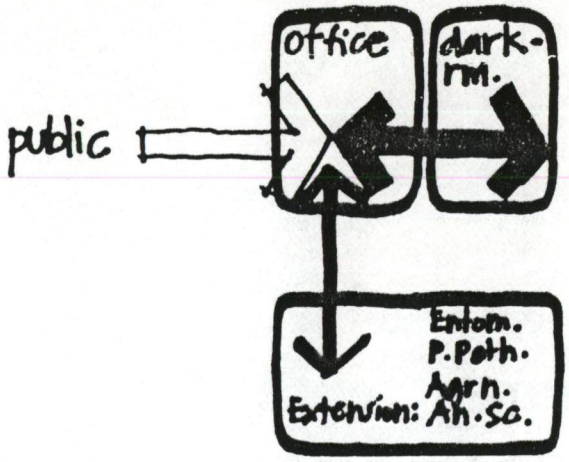
Develops plant studies on computer in office.

Studies plant diseases in laboratory. Works with Entomology.

public relations

The distribution of research findings to the public and increasing the public awareness of the station.





Extension Specialist

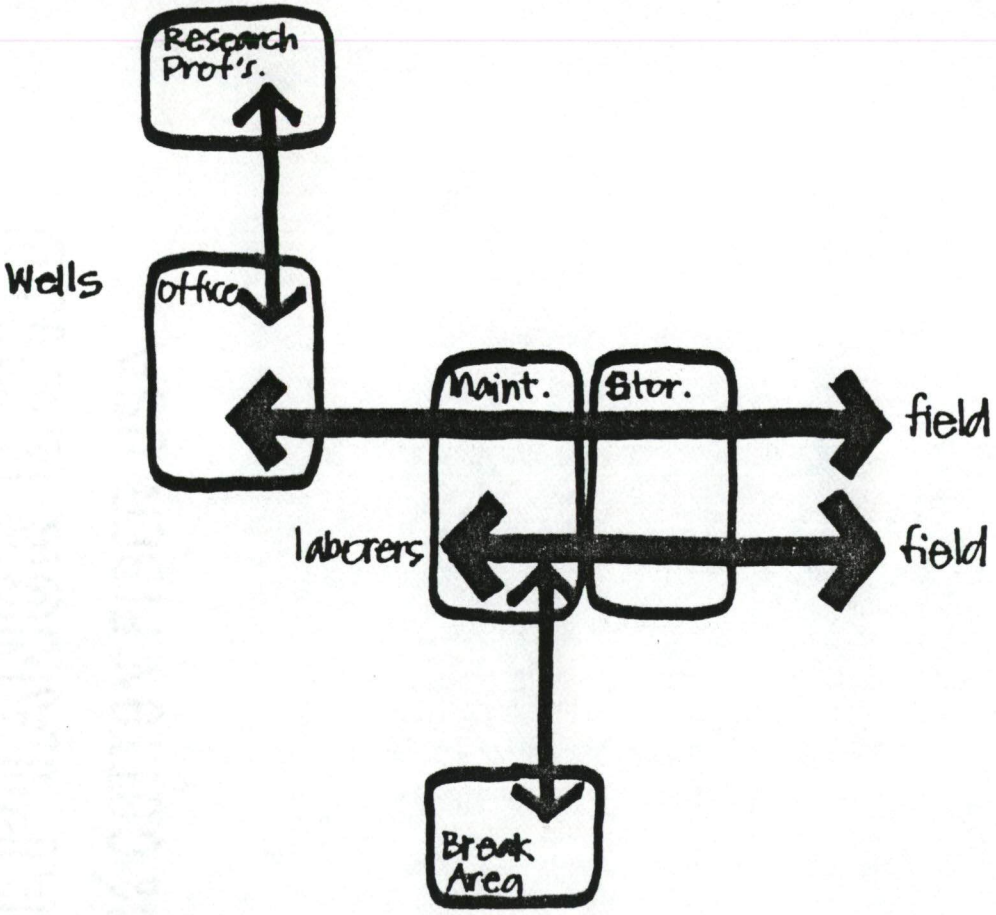
Mr. T. W. Lollis

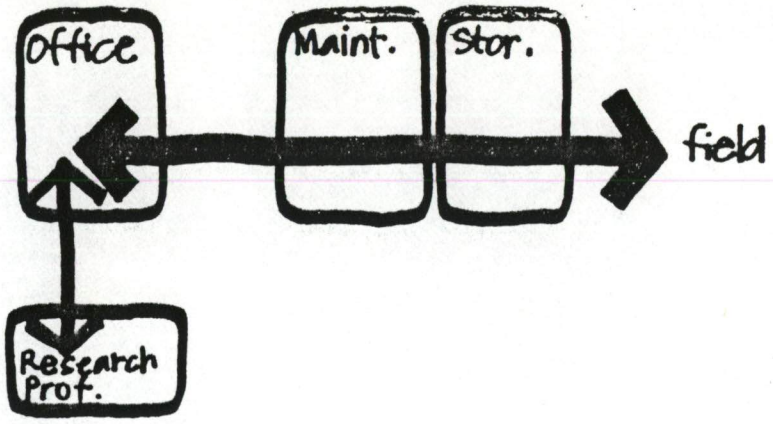
Develops public service educational programs and counsels station and county extension professionals in communications in office.

Processes photography in darkroom.

field

The operation and care of fields and farm equipment.





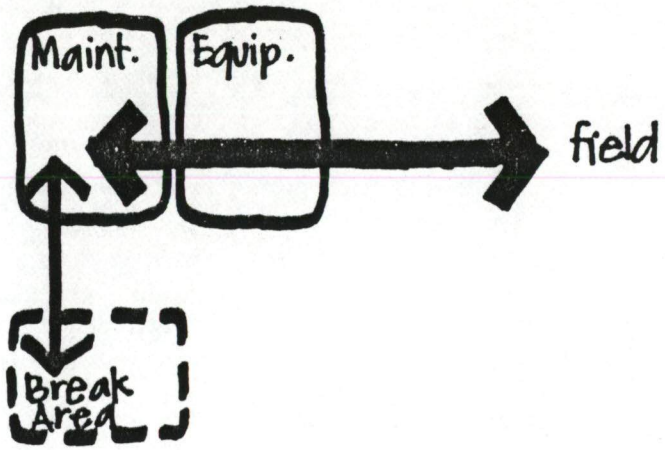
Farm Manager

Mr. G. Wells

Plans field care organization in office.

Services equipment in storage buildings.

Supervises farm workers and checks weather in the field.



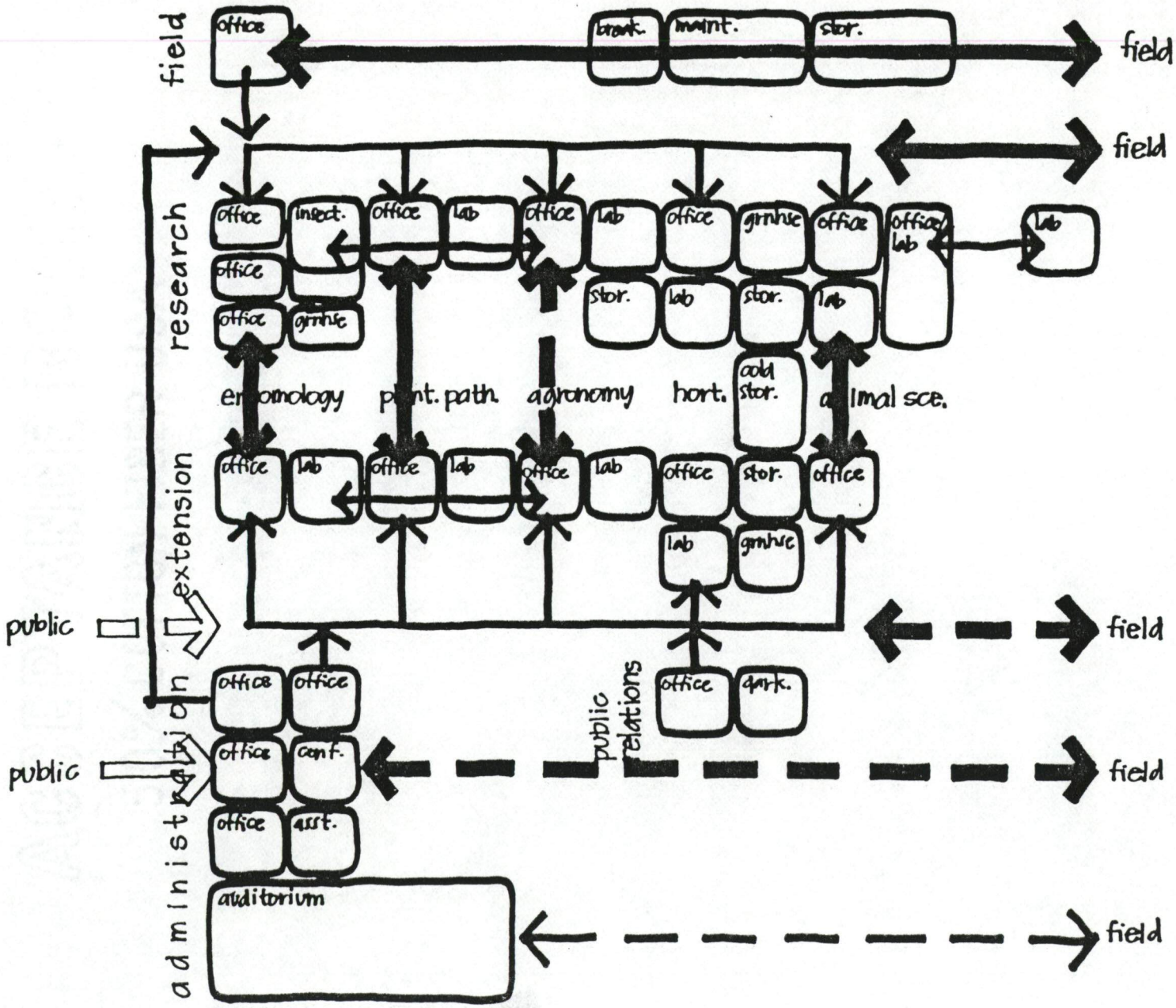
Laborers

Service equipment in storage buildings.

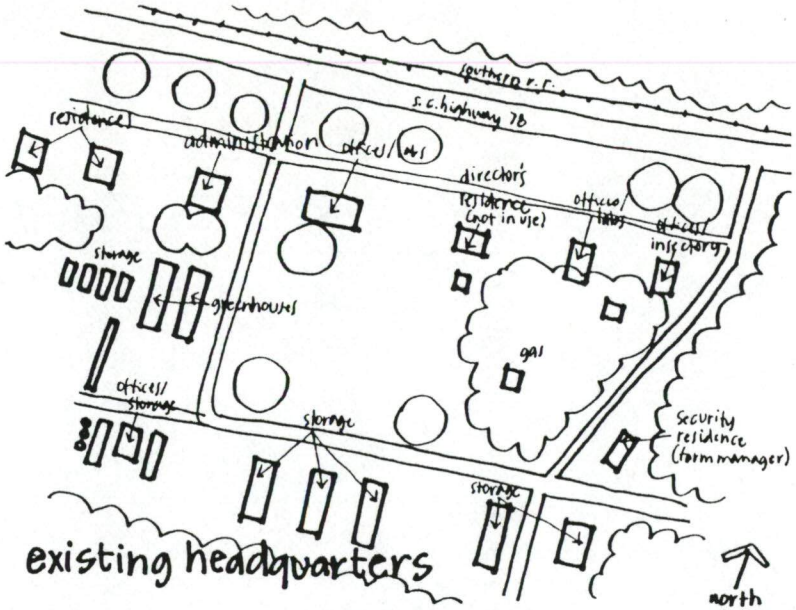
Operate equipment and care for crops in field.

summary

A spatial relationship summary of administration, extension, research and field components.

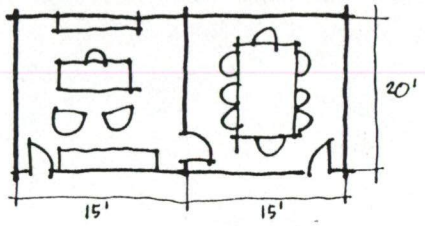


needs



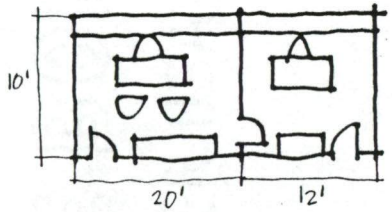
The needs analysis is a quantitative description of space requirements for the new Research and Education Center. An examination of the existing facilities reveals that they are inadequate for either current or future needs.[28] This analysis examines the needs of the administration, extension, research, and field components.

administration



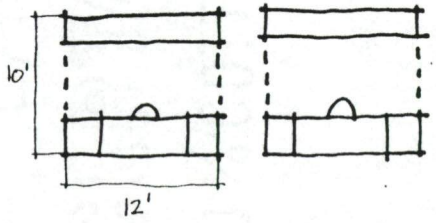
Director

Office with desk, files, shelves, space for 2-4 people for meeting. An adjacent conference room for 15-20 people.



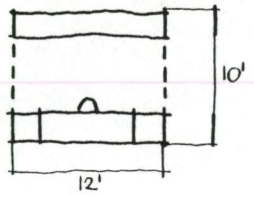
Bookkeeper

Office with desk, files and work space for one assistant.



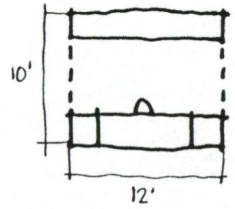
General Secretary

Work space for desk, files, and one additional secretary.



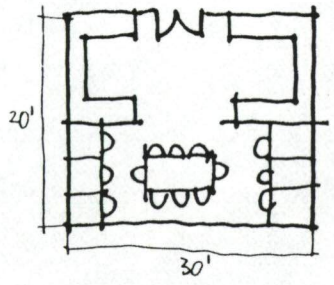
Extension Secretary

Work space for desk, files, work table and shelves.



Research Secretary

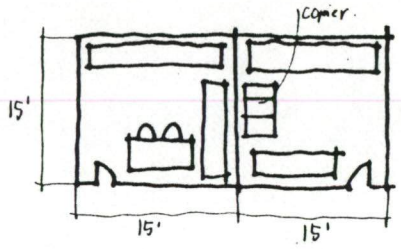
Work space for desk, files, work table and shelves.



Additional Functions:

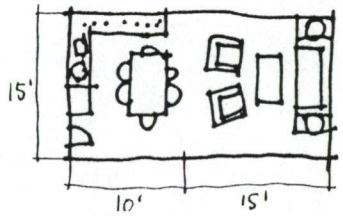
Library

Room for book shelves, conference table, and study space.



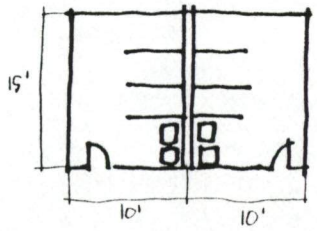
Records/Work Space

Work area for copier, work table, files, and storage.



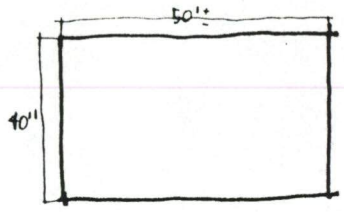
Lounge

Room for kitchen area (sink, stove, refrigerator, cabinets), mail area, and seating area.



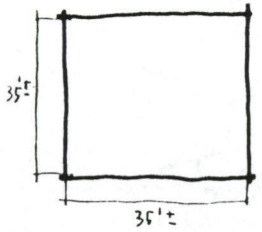
Bathrooms

Adequate facilities for staff and public



Security Residence

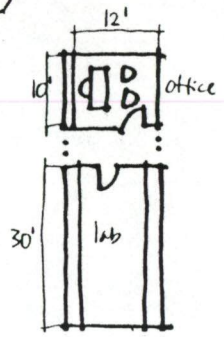
House for Farm Manager.



Student Residences

Living space for eight students.

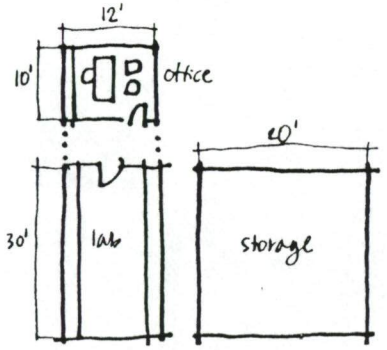
agronomy



Extension Scientist

Office with desk, files.

Laboratory with counter work space.

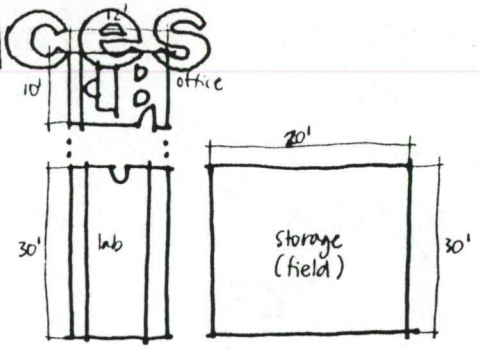


Research Scientist

Office with desk, shelves.

Laboratory with work area and seed drying room. Storage buildings for seed.

animal sciences

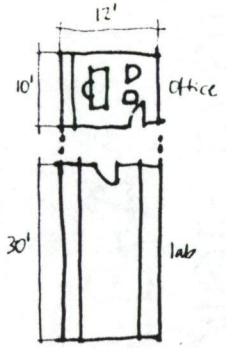


Extension Scientist

Office with desk and shelves.

Laboratory with computer area.

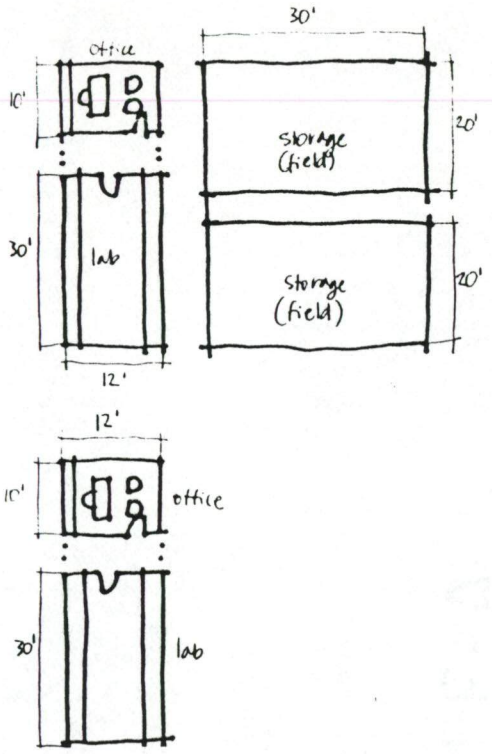
Field laboratory for feed storage and preparation.



Extension Scientist (new)

Office with desk and storage.

Laboratory



Research Scientist

Office with desk and shelves.

Laboratory with computer and storage.

Field laboratory for feed preparation and storage.

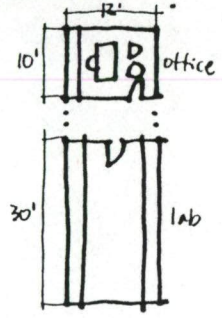
Research Scientist

Office with desk, shelves, and storage.

Laboratory

Field storage for clean-up and general storage.

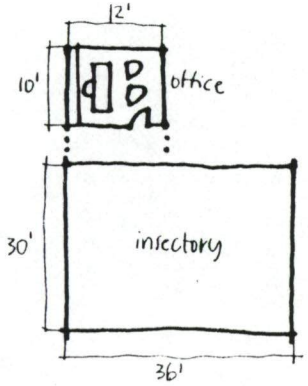
entomology



Extension Scientist

Office with desk, files, shelves.

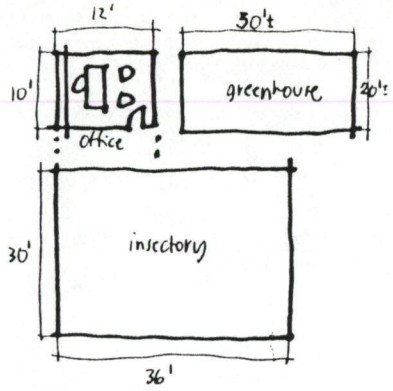
Laboratory with work space for computer, microscope and student help.



Research Scientist

Office with desk and shelves.

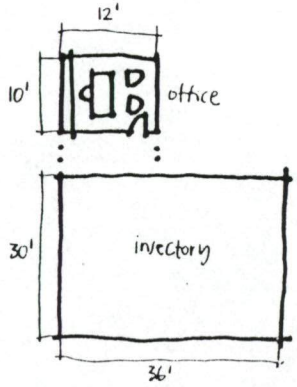
Insectory



Research Scientist

Office with desk and shelves.

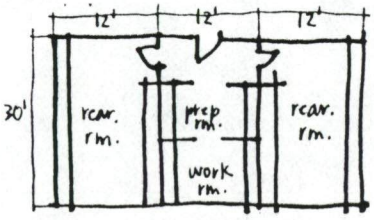
Insectory. Greenhouse.



Research Scientist

Office with desk and shelves.

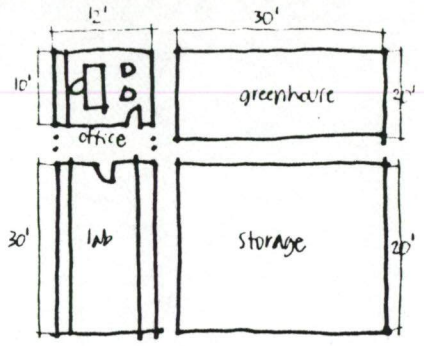
Insectory.



Insectory

Work room. Preparation room. Two insect rearing rooms with isolation from other laboratories.

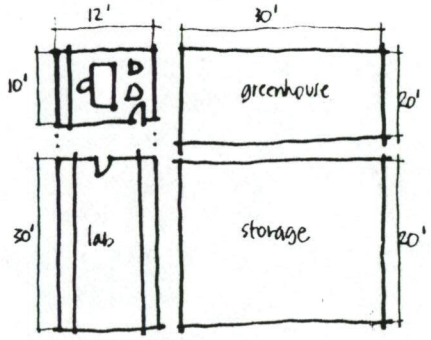
horticulture



Research Scientist

Office with desk and general work area.

Laboratory for potato processing. Greenhouse. Cold/dry storage space for potatoes.

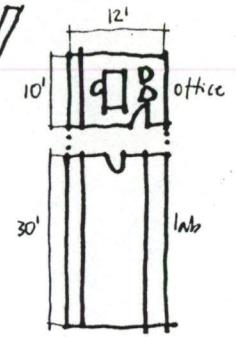


Research Scientist

Office with desk, cabinets, and shelves.

Laboratory for seed analysis. Greenhouse. Cold/dry storage for watermelons.

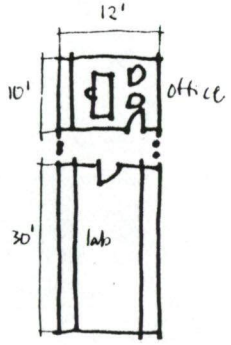
plant pathology



Extension Scientist

Office with desk, work area, and storage.

Laboratory.

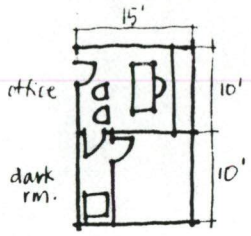


Research Scientist (new)

Office with desk, storage, and shelves.

Laboratory.

public relations

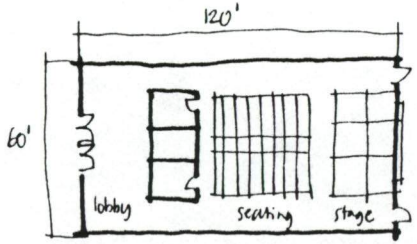


Extension Specialist

Office with desk and storage.

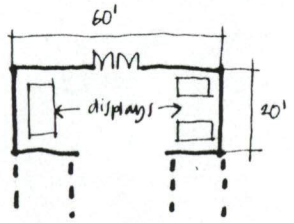
Laboratory for photography processing.

Additional Functions



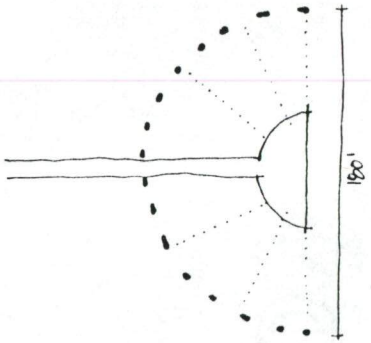
Auditorium

Flexible space to seat 300± people and hold smaller meetings. Bathrooms.



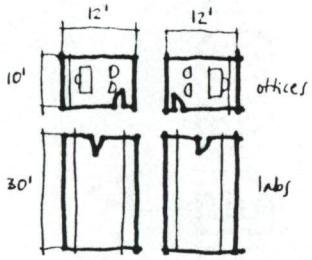
Indoor Display Area

Space for displays.



Outdoor Exhibit Area

Space for 300± people for exhibits and demonstrations.

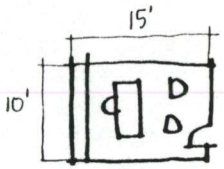


Agricultural Engineering (Extension and Research)

Offices

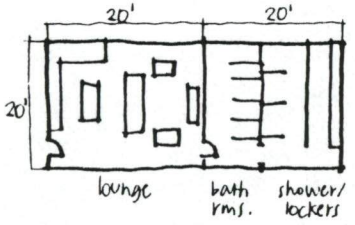
Laboratories

field



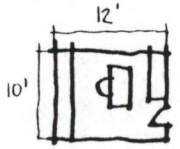
Farm Manager

Office with desk and storage.



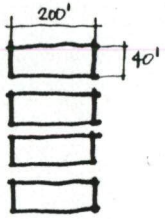
Laborers

Space for break room, clean-up area, and bathrooms for 39± workers.



Maintenance Supervisor

Office with desk and storage.



Additional Functions:

Storage

Space to store equipment, maintenance, seed, and chemicals.

administration

	NUMBER	AREA
Director	1 @ 240	240
Bookkeeper	1 @ 200	200
Asst. Bookkeeper	1 @ 120	120
General Secretary	2 @ 120	240
Extension Secretary	1 @ 120	120
Research Secretary	1 @ 120	120
Library	1 @ 600	600
Conference Room	1 @ 240	240
Records/Work Space	2 @ 200	400
Lounge	1 @ 200	200
Security Residence		3,000
Student Residences		1,300
Sub-total		5,780 SF

extension

	NUMBER	AREA
Agricultural Engineering		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Agronomy		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Animal Sciences		
Office	2 @ 120	240
Laboratory	2 @ 240	480
Entomology		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Plant Pathology		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Public Relations		
Office	1 @ 120	120
Darkroom	1 @ 100	100
Auditorium		8,000
Indoor Display		800
Sub-total		11,180 SF

research

	NUMBER	AREA
Agricultural Engineering		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Agronomy		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Storage	1 @ 450	450
Animal Science		
Office	2 @ 120	320
Laboratory	2 @ 240	480
Field Storage	2 @ 450	900
Entomology		
Office	3 @ 120	360
Insectory		
Rearing rooms	2 @ 240	480
Prep. room	1 @ 120	120
Work room	1 @ 120	120
Greenhouse	1 @ 450	450
Storage	1 @ 450	450
Horticulture		
Office	2 @ 120	240
Laboratory	2 @ 240	480
Greenhouse	2 @ 450	900
Storage		
Sweet potato	1 @ 1000	1,000
Watermelon	1 @ 300	300
Cold room	1 @ 240	240

	NUMBER	AREA
Plant Pathology		
Office	1 @ 120	120
Laboratory	1 @ 240	240
Sub-total		8,290

field

	NUMBER	AREA
Farm Manager	1 @ 200	200
Maintenance Supervisor	1 @ 120	120
Laborers		
Break Room	1 @ 400	400
Clean-up Room	1 @ 400	400
Storage		
Equipment	2 @ 8,000	16,000
Maintenance	2 @ 3,000	6,000
General	2 @ 3,000	6,000
Chemical	1 @ 4,000	4,000
Sub-total		33,120 SF

summary

	AREA
Administration	
Net	5,780
Circulation, Mechanical, Structural (30% of net)	1,734
Total	7,514
Extension	
Net	11,180
Circulation, Mechanical, Structural (30% of net)	3,354
Total	14,534
Research	
Net	8,290
Circulation, Mechanical, Structural (30% of net)	2,487
Total	10,777
Field	
Net	33,120
Circulation, Mechanical, Structural (30% of net)	9,936
Total	43,056
Total Building Area	75,881

	NUMBER	AREA
Parking		
Visitors	24 @ 300 (plus overflow area for 300±)	7,200
Staff	26 @ 300	7,800
Laborers	39 @ 300	11,700
Total		26,700 SF

resources

BUILDING CODES

The buildings of the Research and Education Center must conform with the requirements of the Southern Standard Building Code.

General Requirements

Occupancy Classification - mixed occupancy with principal intended use as educational.

Construction Type - Type I or Type II

Maximum Allowable Height - No limit (Type I) 80 ft. (Type II).

Maximum Allowable Floor Area - No limit (Type I or II).

Offices

Exits - Maximum travel distance is 150' (unsprinklered), 200' (sprinklered), 44" minimum exitway.

Roof Loads - 50 psf (offices), 100 psf (corridors), 125 psf (libraries).

Auditorium

Occupancy Classification - Small assembly (300± people), moveable seats.

Aisles - 42" or equal to wider aisle.

Seating - Maximum 14 seats per row, 12"+ clear passage in row.

Exits - 3 (main entry and 2 at farthest distances).

Loads - 100 psf.[29]

DESIGN CRITERIA

The laboratories must conform to the standards of laboratory planning.

Size - 10'+ wide x 24'+ long module.
Aisle width of 5' min.

Drainage - Separate sanitation, waste, chemical contaminated water.

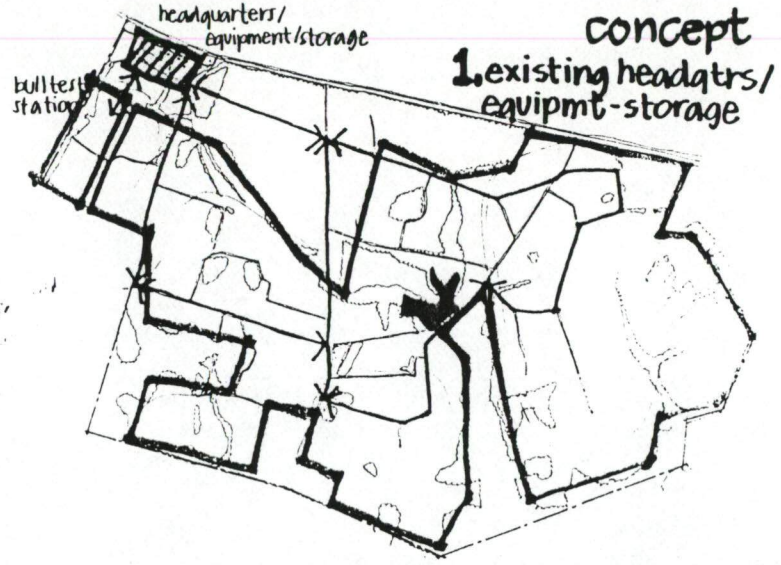
Plumbing - Supply cold/hot water, distilled water, vacuum, and gas. Water pressure and supply storage is important (gravity tank).

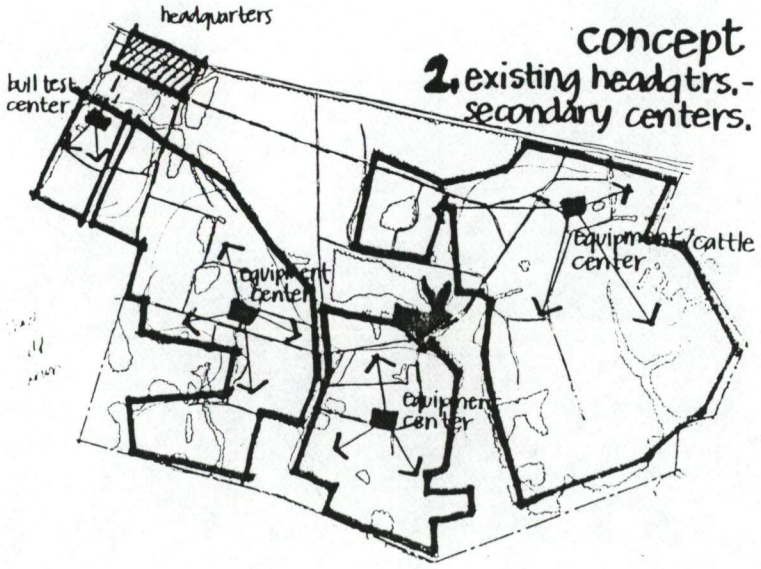
Air System - Separate lab control air supply with no return. Adequate ventilation and exhaust hoods (where needed); horizontal ceiling air distribution system is best.[30]

Planning Studies

The planning studies analysis advances the project objectives of the Research and Education Center of the Edisto Station into a design proposal. Land use and roadway alternatives are developed from the conclusions of the site and program analysis, and are the basis for the design of the Research Center.

land use

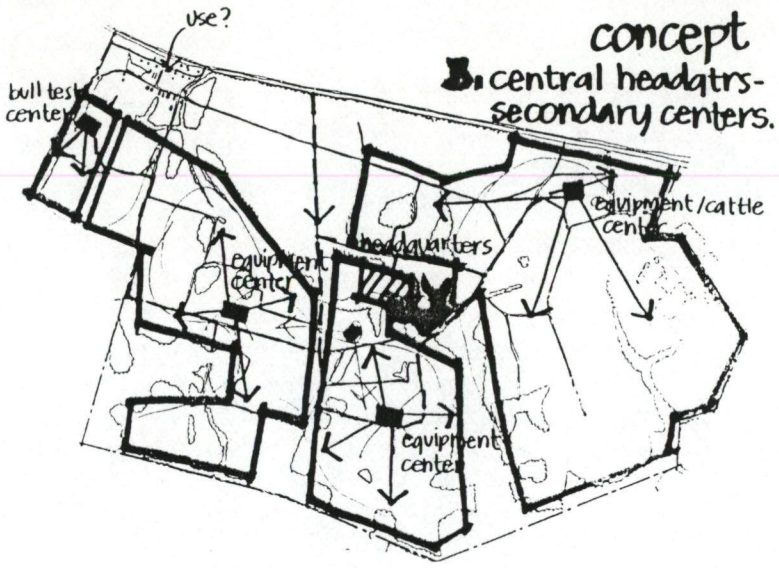




The land use alternatives analysis reveals three locations for the Research Center at the Edisto Station. They are the:

1. Existing research center and storage areas.
2. Existing research center with new station storage sub-centers.
3. New central research center with storage sub-centers.

The first two alternatives locate the new Research Center at the existing headquarters area. The primary advantage of this location is its public exposure to Highway 78 and the ability to build upon an existing physical plant. The disadvantages are the inadequate spaces in the existing buildings if they were to be renovated, and the excessive distance from the buildings to the fields on the south and east periphery. Alternative two attempts to eliminate the distance of equipment storage to the fields, but does not alleviate the travel distance for researchers.



The final alternative is to locate the new Research Center in a central area of the station, near the lake, as was concluded from the site analysis. The advantages to this approach include: the minimum distance from the station facilities to all the fields, an attractive setting, and the ability to develop an optimum facility without being constrained by existing buildings. The principal disadvantage is lack of public exposure on Highway 78.

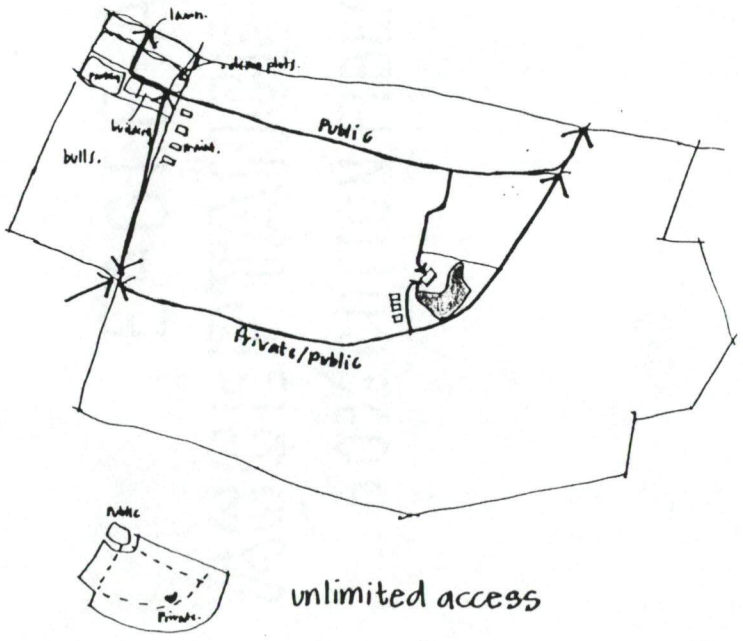
Assuming that the lack of highway recognition can be compensated for with proper signage, the third alternative of locating the Research Center in the middle of the station property offers the most advantages and this is the site that will be used for this project.

roadway

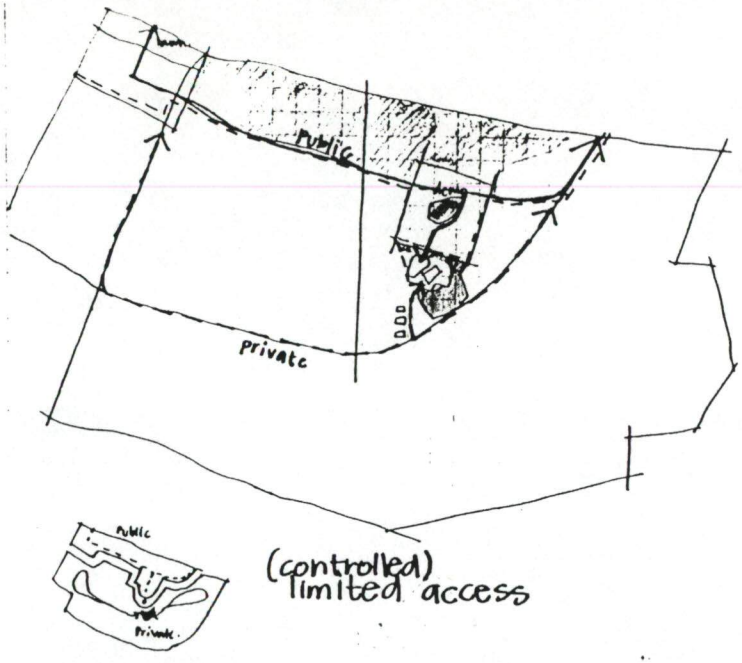
The roadway alternatives study analyzes the public and private circulation on the station and the need for points of interaction. The public should have more awareness of station activities without conflicting with private work. The private users require efficient movement throughout the station field areas and interaction with the public at a central point. The following are two alternatives:

1. Unlimited access
2. Controlled access.

The unlimited access approach permits the public to enter the station at several points and use alternative routes to arrive at the Research Center. The advantage of this is maximum public exposure to station activities. The disadvantages are the conflict between public and private circulation, and the inability of establishing a clearly defined public entry at the Research Center.



unlimited access

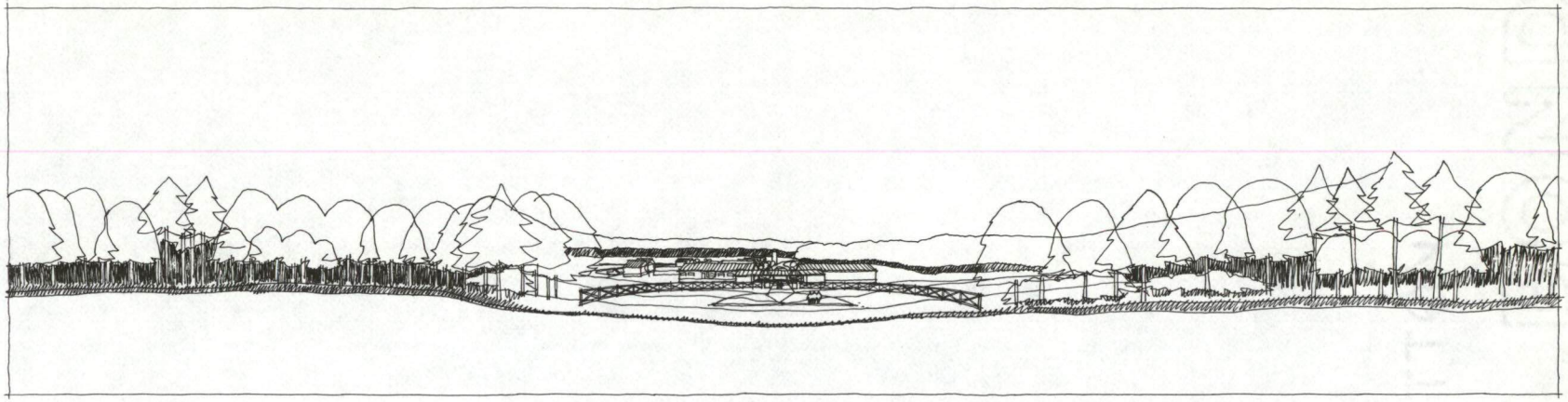


Alternative two, the controlled access, would separate public from private circulation, by establishing a defined public route from Highway 78 to the Research Center. The public entry to the buildings would be clearly defined and distinct from private movement and activity areas.

The controlled access alternative would appear to be the most desirable in establishing an appropriate order and control to the movement on the station property, as well as in and around the Research and Education Center. Therefore, this approach will be used in planning the project.

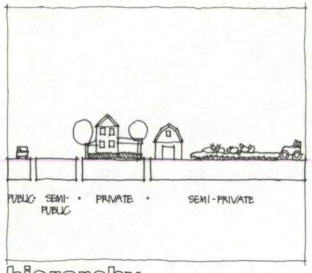
Design Proposal

The design proposal organizes the Research Center spaces in response to the public and private access. Of particular importance is the continuity of the public to private progression through the building and the clarity of the public and private interaction areas. Specifically, in the Extension and Research Departments, there is a definite hierarchy of public spaces (offices) and then more private spaces (laboratories, greenhouses, storage, and fields) linked by a public and private interaction corridor. The continuity of public and private progression in the design proposal, establishes the new Research and Education Center as an integral part of the overall planning framework of the Edisto Station.

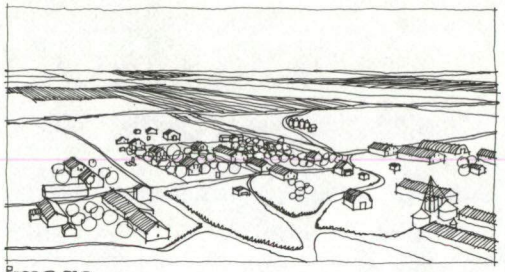


Research and Education Center
Edisto Experimental Station

A Terminal Project submitted to the Faculty of the College of Architecture, Clemson University, in partial fulfillment of the requirements for the degree of Master of Architecture. April 17, 1983. Clark Templeton. Ephesians 3:20,21



hierarchy



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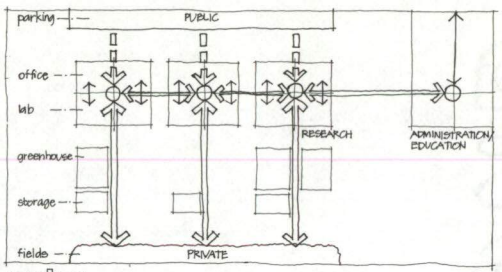
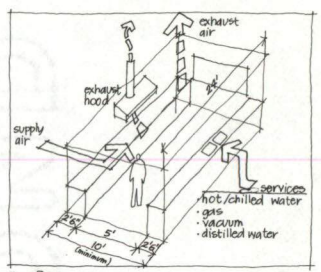


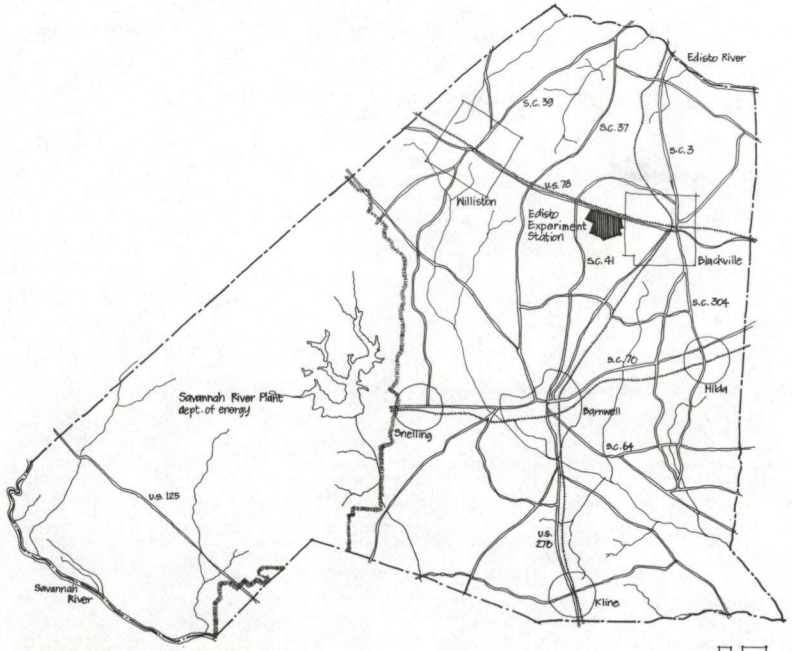
order



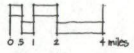
lab

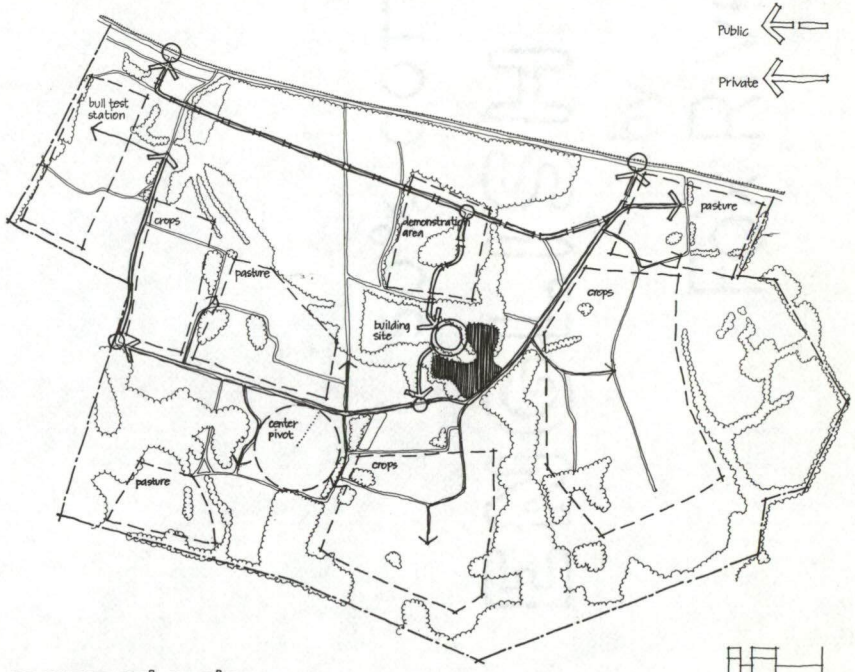
setting

needs



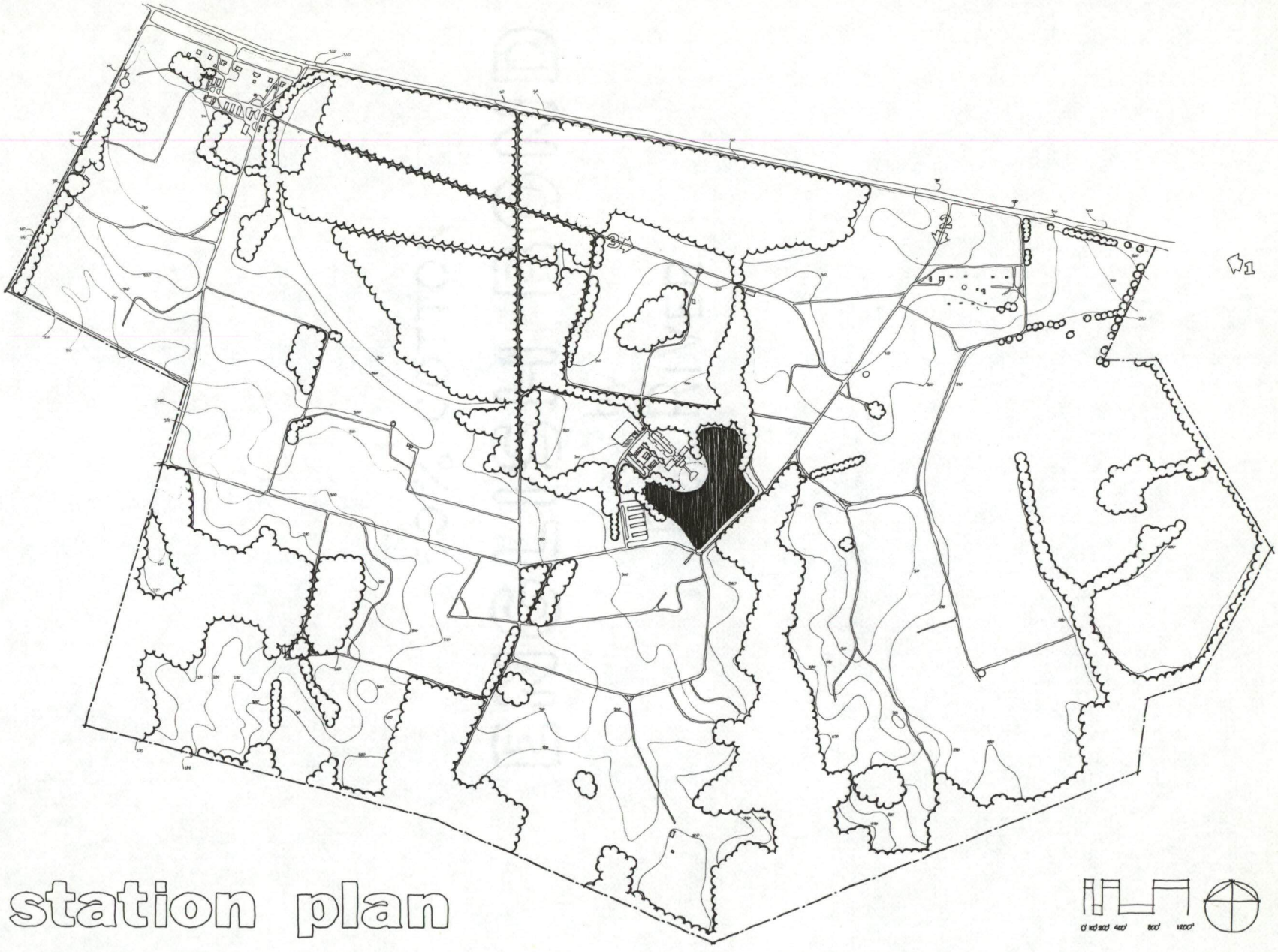
barnwell county



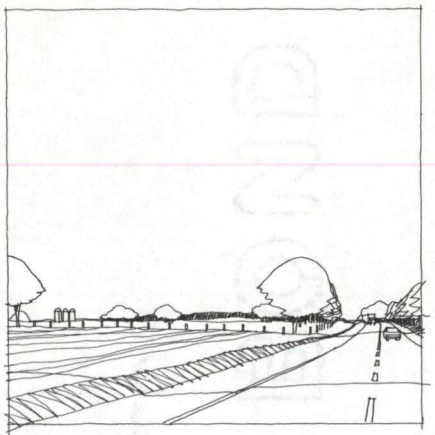


movement system

context



station plan



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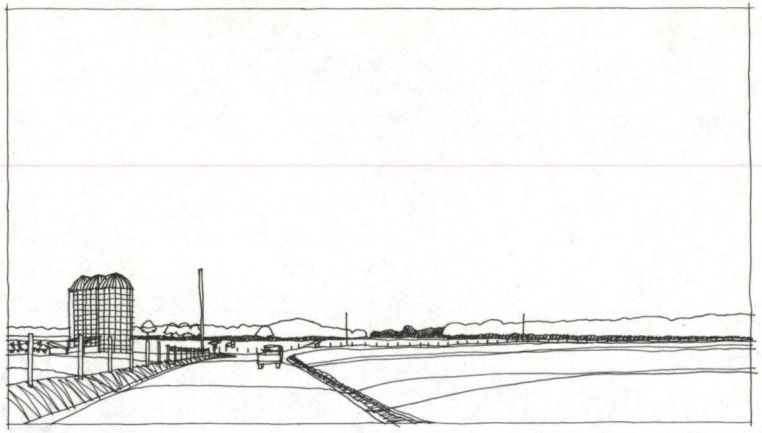

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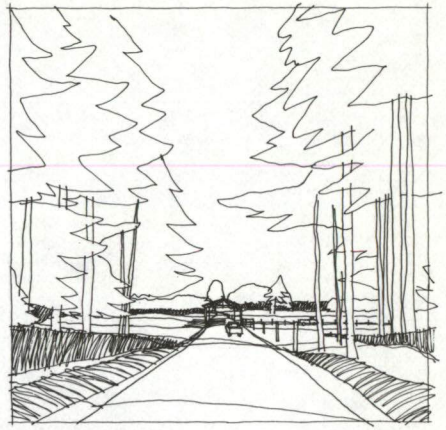

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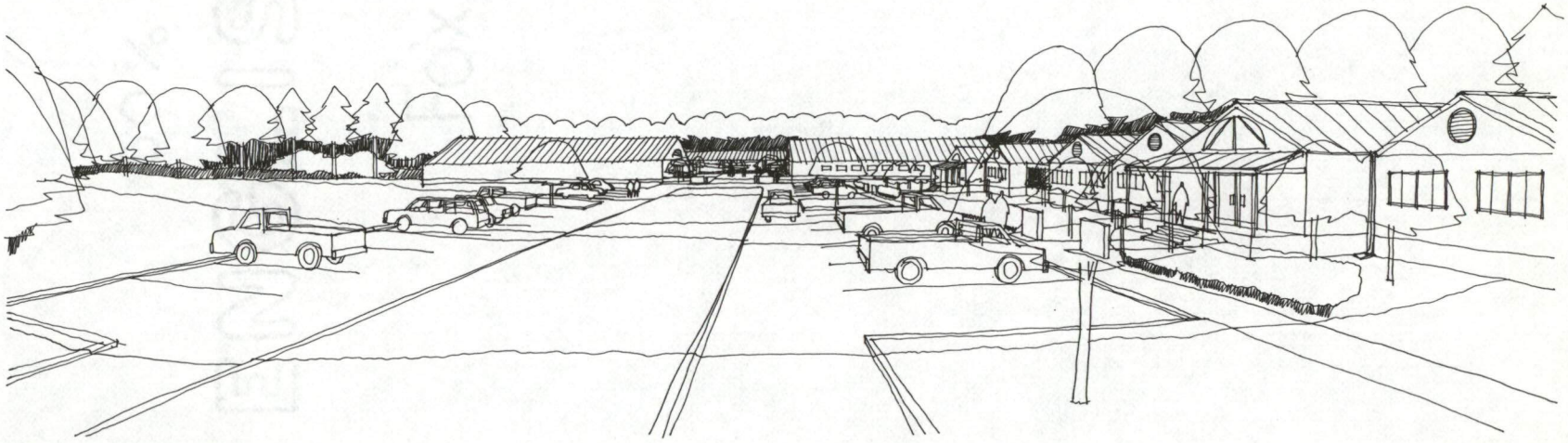
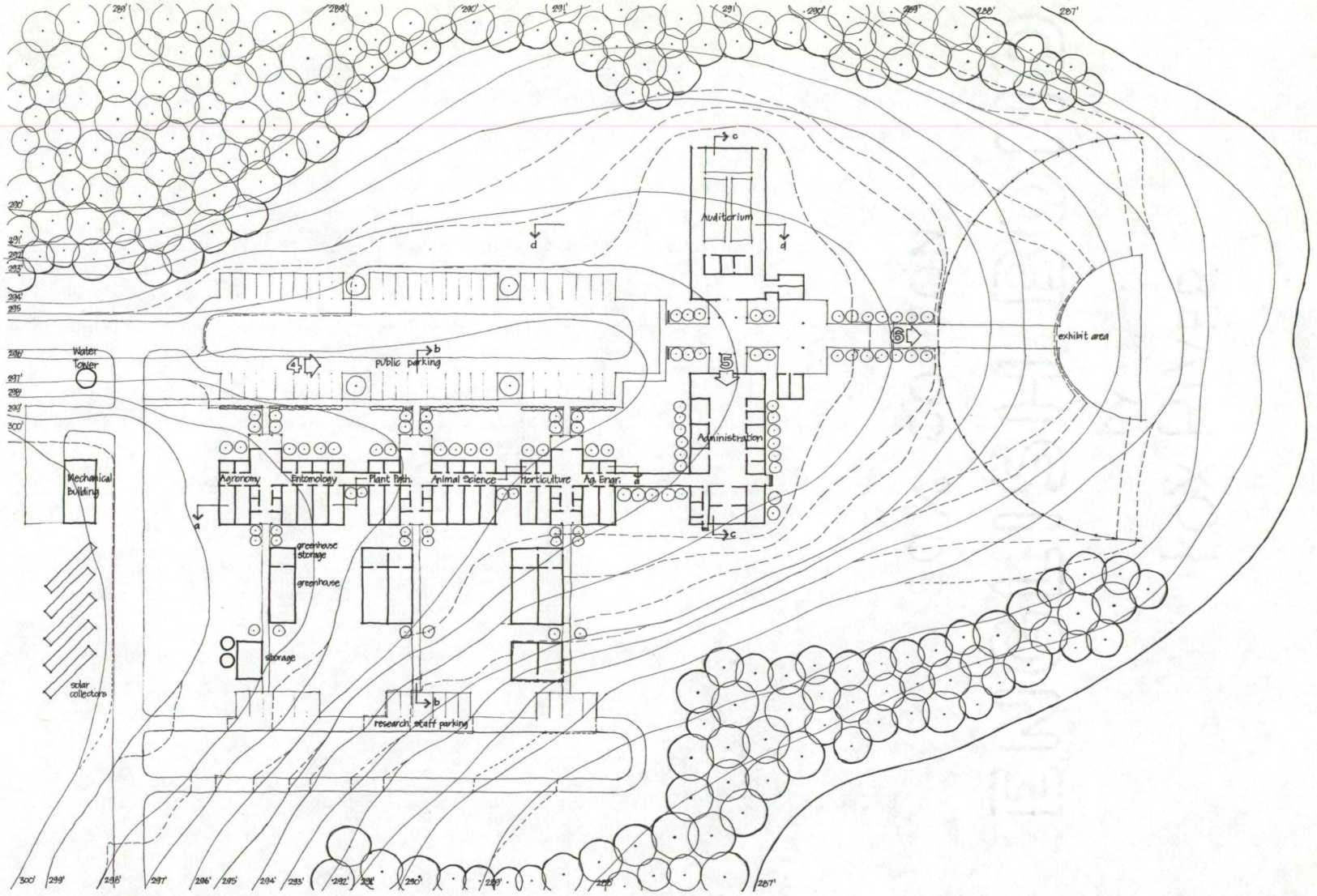
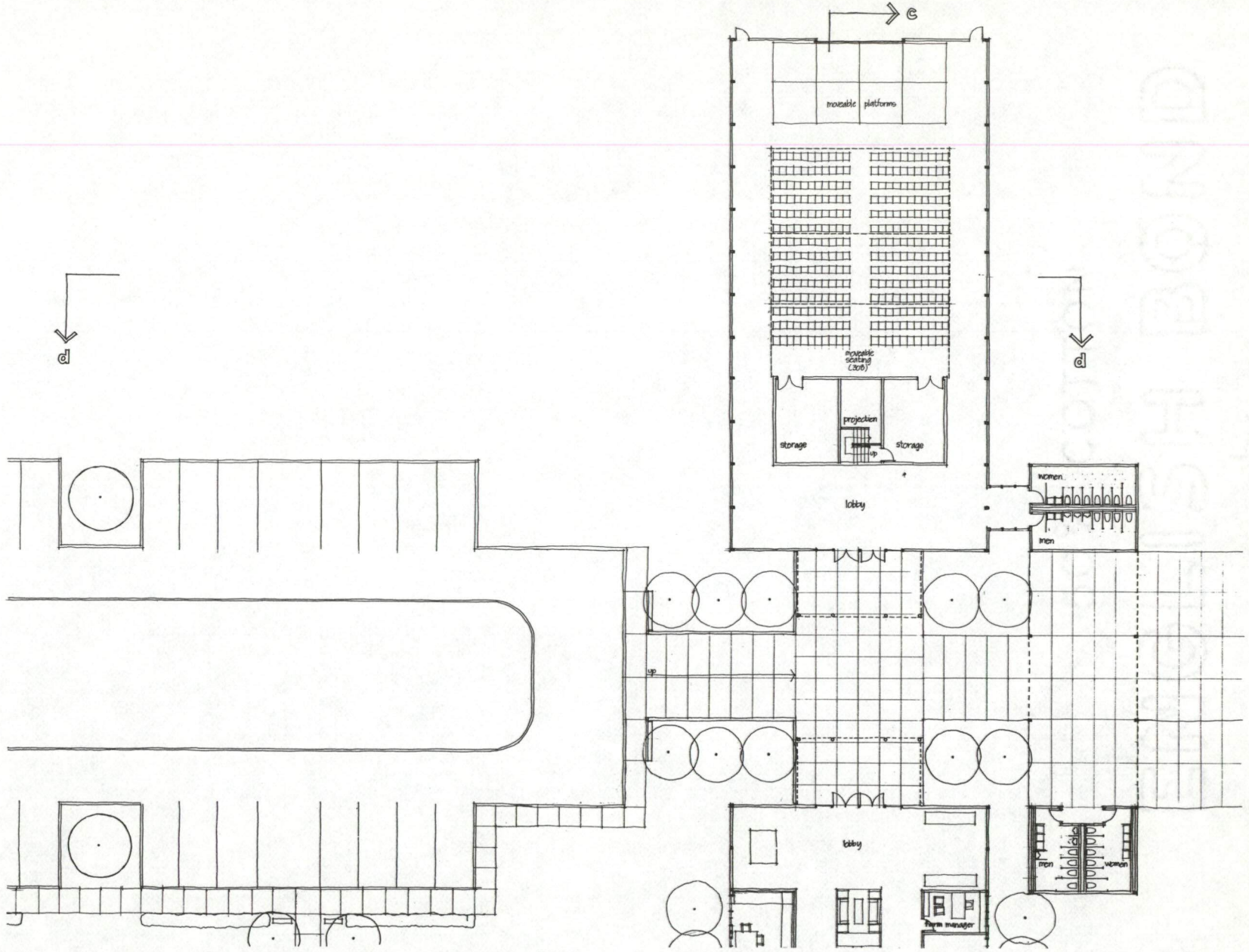


4.building center

exterior


auditorium
exhibit area
public parking
Water Tower
Mechanical Building
Agronomy
Entomology
Plant Path.
Animal Science
Horticulture
Ag. Engr.
Administration
greenhouse storage
greenhouse
storage
solar collectors
research staff parking

center plan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movable platforms
movable seating (300)
projection
storage
storage
up
lobby
women
men
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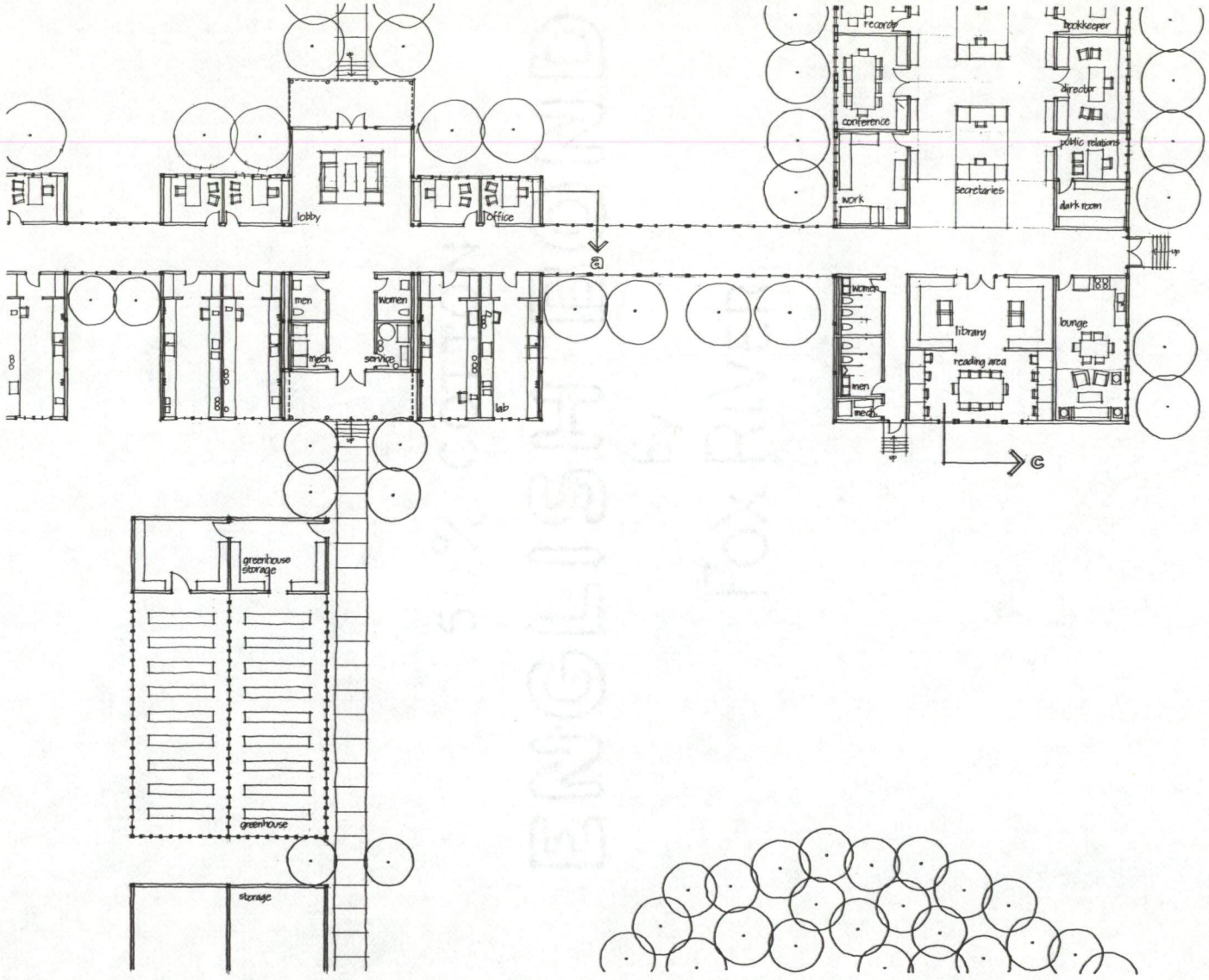
d
up
lobby
men
women
farm manager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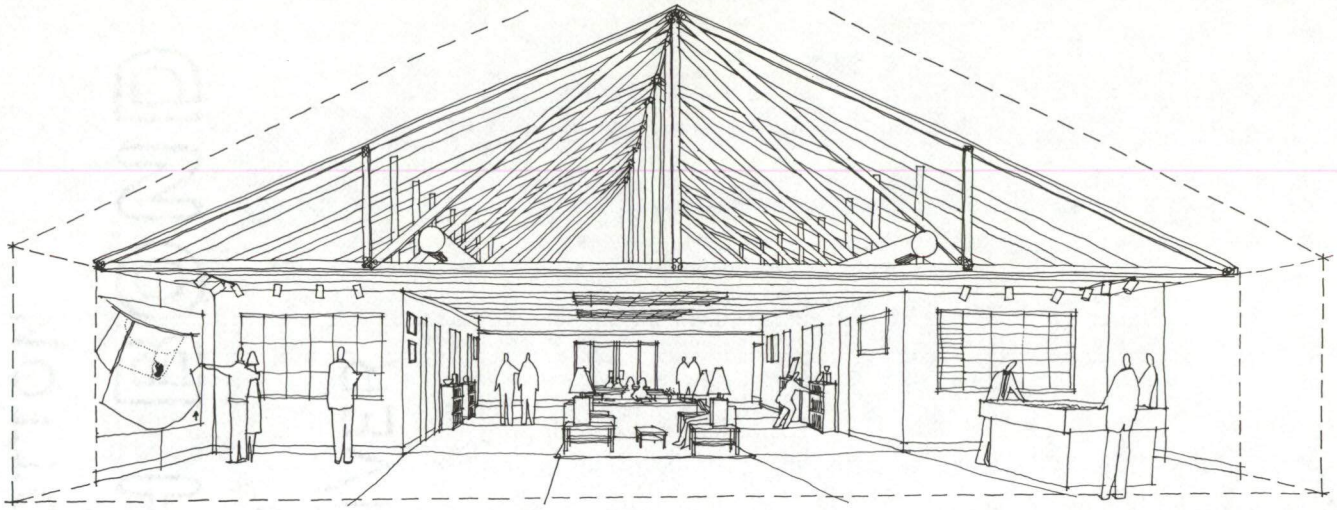
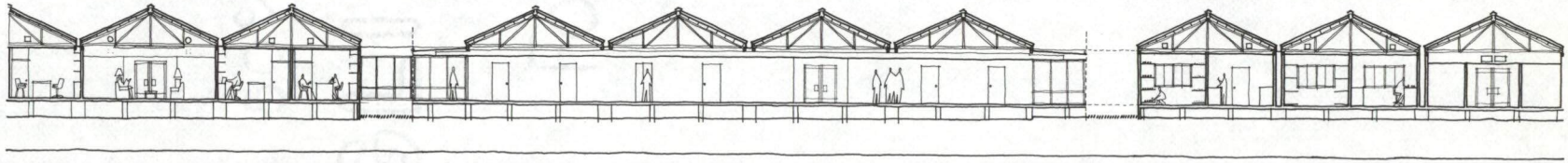
office
men
women
mech.
service
lab
greenhouse storage
greenhouse
storage
recorder
bookkeeper
director
conference
public relations
work
secretaries
dark room
women
library
lounge
reading area
linen
mech.
a
c

plan detail



5.administration

interior



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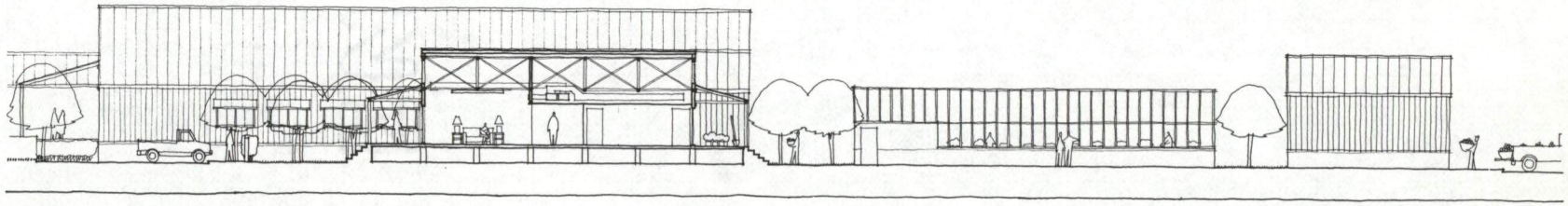

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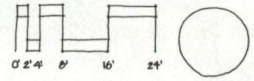
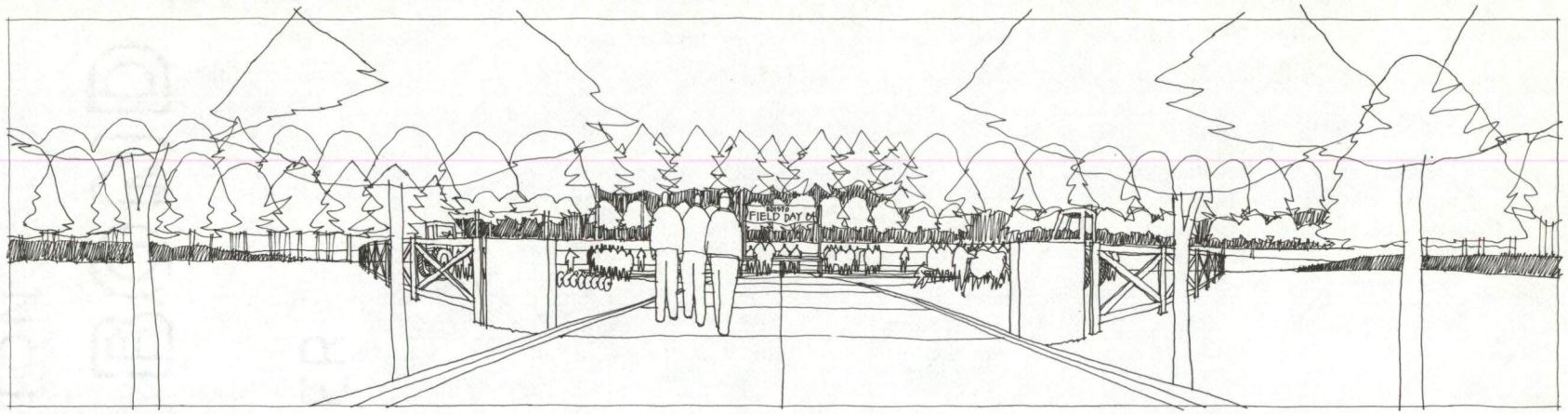
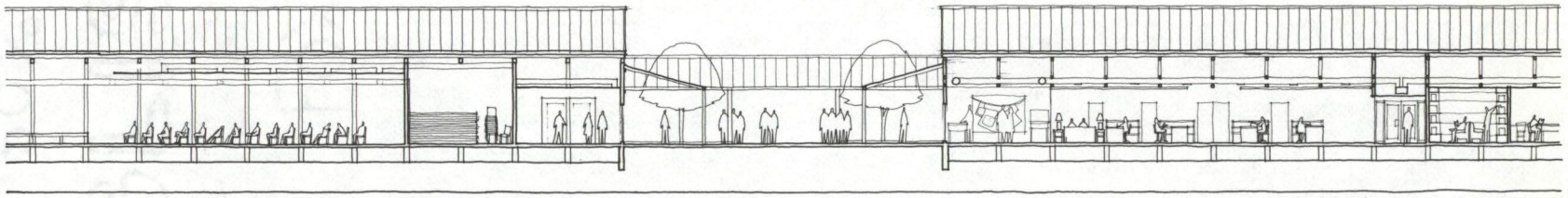
sections





6.exhibit area

exterior



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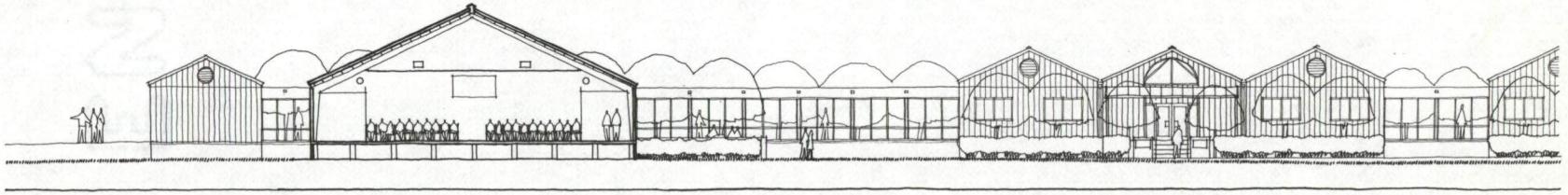

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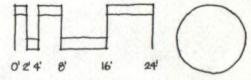
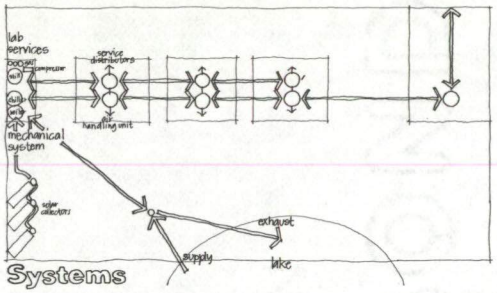
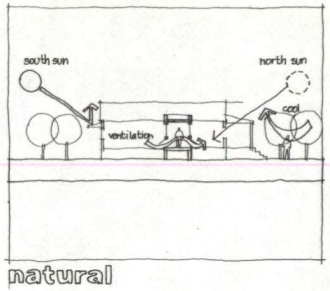
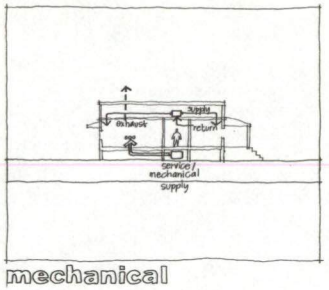




Systems



natural



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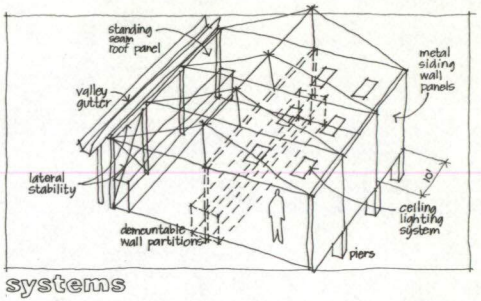
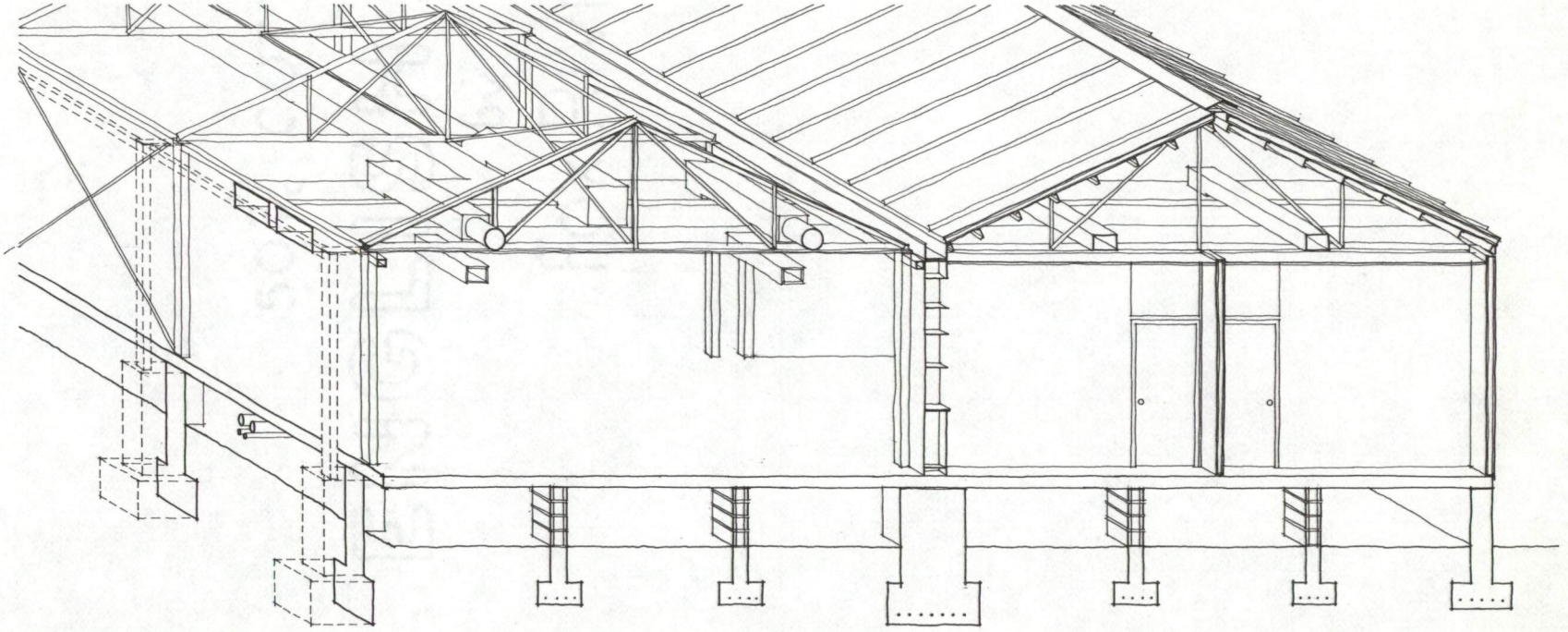


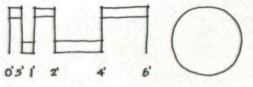
systems

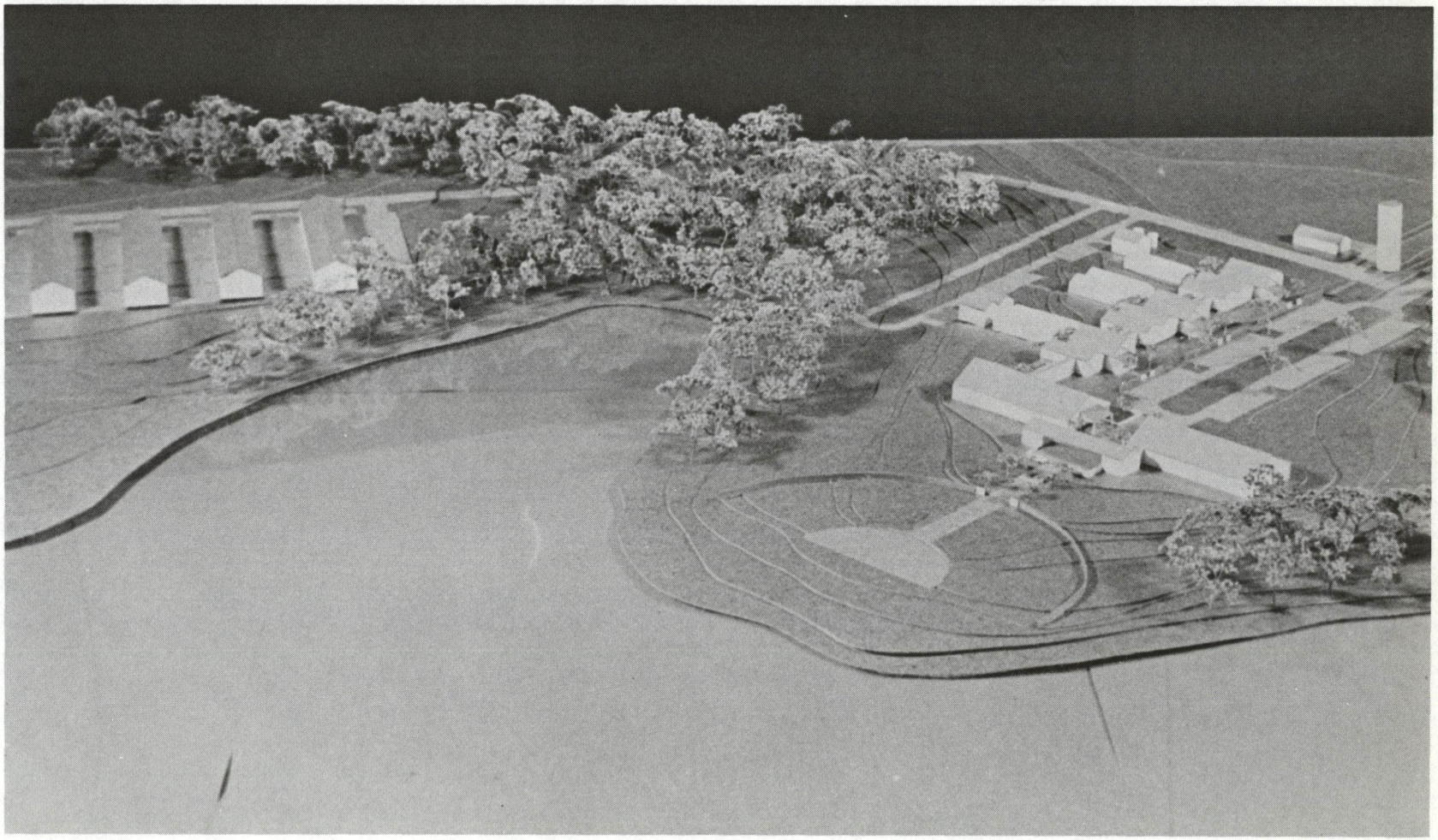
energy

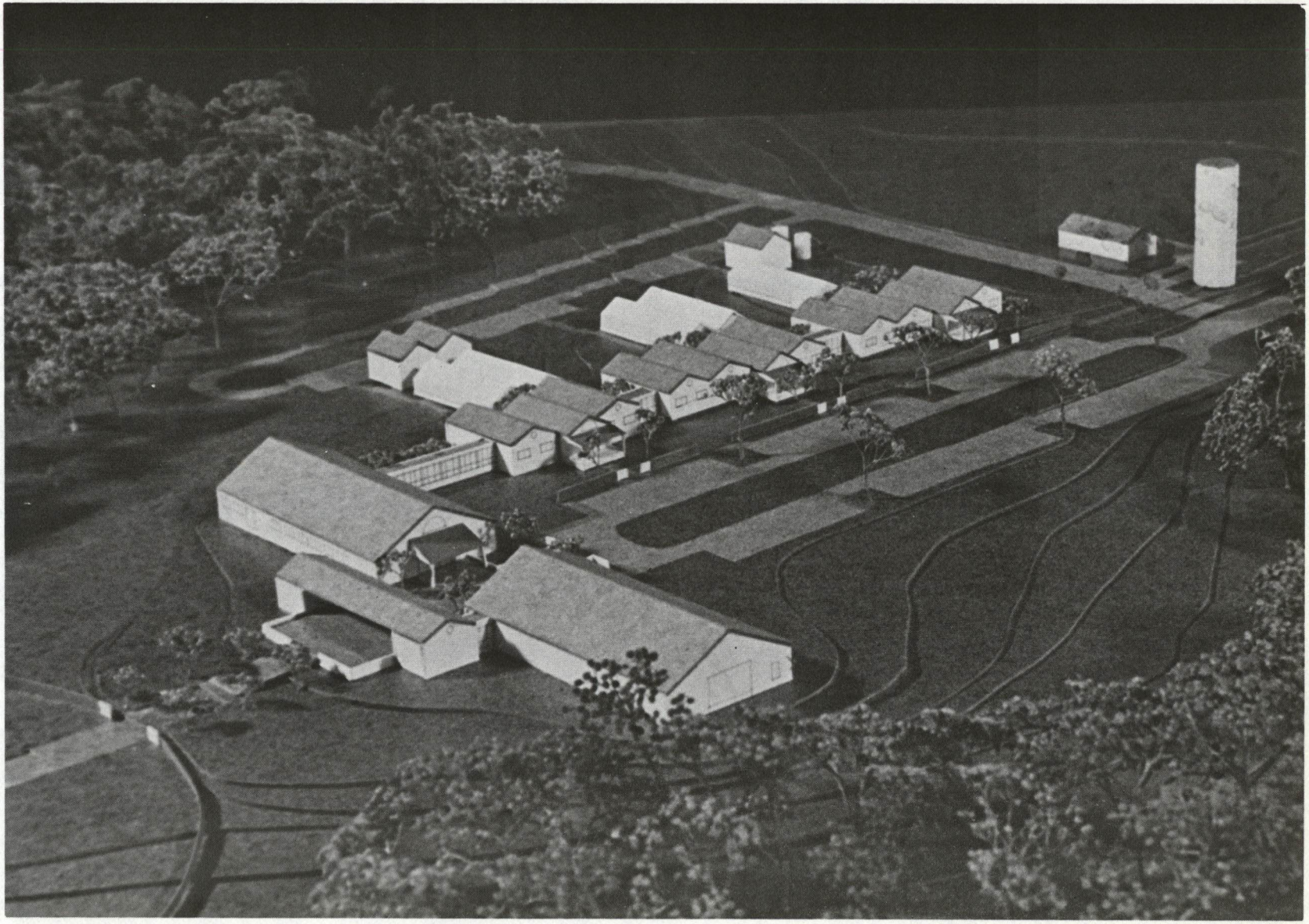
structure



framework







Notes

[1] William Morris, ed., The American Heritage Dictionary of the English Language (Boston, Massachusetts: Houghton Mifflin Company, 1979), p. 26.

[2] Richard Britz, The Edible City Resource Manual (Los Altos, California: William Kaufmann, Inc., 1981), p. xiv.

[3] S.C. Statistical Abstract (S.C. Division of Research and Statistical Services, 1982), p. 9.

[4] Paul Waggoner, "The Agricultural Experiment Station and the Human Condition."

[5] Ibid.

[6] "A Better Future Through Research" (S.C. Agricultural Experiment Station).

[7] Pee Dee Research and Educational Center Development Plan.

[8] Veril A. Rogers, Soil Survey of Barnwell County, South Carolina, Eastern Part (U.S. Dept. of Agriculture, Soil Conservation Service with S.C. Agricultural Experiment Station and S.C. Land Resources Commission, 1977).

[9] Edisto Experiment Station: Self Evaluation Study, 1981, p. 1.

[10] A.W. Snell, Interview, Nov. 8, 1983.

[11] J. R. Hill, Jr., Interview, Dec. 20, 1983.

[12] Edisto Experiment Station: Self Evaluation Study, 1981, p. 31.

[13] Ibid., pp. 23-26.

[14] Ibid., pp. 24-27.

[15] Ibid., pp. 23-28.

[16] Ibid., pp. 24-28.

[17] Ibid., p. 24.

[18] Ibid., p. 9.

[19] Ibid., pp. 4-7.

[20] Ibid., p. 8.

[21] Ibid., p. 6.

[22] Ibid., pp. 2-4.

[23] George Wells, Interview, Dec. 20, 1983.

[24] Wilkins and Woods, Architects, Pee Dee Research and Education Center Plans, 1983.

[25] "Ulrich Franzen's Changing Design Solutions for a Changing Era," Architectural Record (New York: McGraw-Hill, Inc., Sept. 1975), pp. 86, 87.

[26] "A 'Village' Design for a College Campus," Progressive Architecture (New York: Reinhold Publishing Corp., Dec. 1958), pp. 88-101.

[27] Edisto Experiment Station Staff, Interviews, Oct. 31, 1983.

[28] Ibid.

[29] Standard Building Codes (Birmingham, Alabama: Southern Building Code Congress International, Inc., 1979).

[30] Harry F. Lewis, ed., Laboratory Planning for Chemistry and Chemical Engineering (New York: Reinhold Publishing Corp., 1962), pp. 20-41.

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